

EMISSIONS TESTING REPORT 13022
Text and Appendices

PERFORMED FOR:

COVANTA ENERGY GROUP, INC.
Morristown, New Jersey

at the

Huntington Resource Recovery Facility
Huntington, New York
Units 1, 2, and 3 SDA Inlets and FF Outlets
September 2013

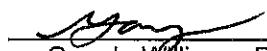
by

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**PE CERTIFICATION
REPORT 13022**

I hereby certify that I have personally examined and am familiar with the information submitted herein. Based upon my own knowledge and my inquiry of those individuals responsible for obtaining the information presented, the foregoing information is true, accurate and complete. I am aware that this information is being requested for the purpose of determining compliance with local, state, and federal laws and may be submitted to appropriate governmental regulatory agencies for those purposes. I am aware that there are significant penalties for submitting false information to such agencies, including the possibility of fine and imprisonment.

Signature



Gary L. Williams, PE, QSTI
Director

Date:

10/8/13

Professional Engineer, State of New York

Seal Number 080333

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1.0 INTRODUCTION

1.1 General

Covanta Energy Group, Inc. (Covanta) operates the Huntington Resource Recovery Facility in East Northport, New York. Covanta contracted TESTAR Engineering, P. C. to conduct an air emissions testing program to quantify specific emissions from Units 1, 2, and 3 for compliance purposes. The testing program was conducted between August 27 and September 06, 2013 by TESTAR Engineering under the supervision of Mr. Rick Kohler of Covanta Energy Group, Inc.

1.2 Test Personnel

Table 1-1 presents the personnel that were involved in the testing program.

**Table 1-1
Test Personnel**

Affiliation	Personnel Responsibility
Covanta Energy Group, Inc.	Rick Kohler Test Coordinator
Covanta of Huntington	Scott Wheeler Test Coordinator
New York State Dept. of Environmental Conservation	Gary E. Zimmerman Test Observer
TESTAR Engineering, P. C.	David Brintle Project Director
	Herbert Dixon, Jr., PE Project Director
	Phil Juneau CEM Test Engineer
	Blake Cone Field Laboratory Manager
	Chris Wrenn Field Laboratory Technician
	Charles Nahrebecki Test Engineer
	Will Snipes Test Engineer
	Eddie King Test Engineer
	Jeff Aims Test Engineer
	Gary Williams, PE, QSTI Test Engineer
	Sean Daley Test Engineer

1.3 Test Parameters and Run Numbers

Tables 1-2, 1-3, and 1-4 present the test dates, sampling locations, flue gas parameters, sampling methods, and run numbers for reference for Unit 1, 2, and 3, respectively.

**Table 1-2
Unit 1 Test Sequence**

Test Location	Sampling Method	Flue Gas Parameter	Run Date	Run Time	Run Number
Unit 1 SDA Inlet	EPA M26A	Hydrogen Chloride	09/04/13	0907-1019	1-I-M26-1
			09/04/13	1140-1255	1-I-M26-2
			09/04/13	1419-1532	1-I-M26-3
	EPA M29	Mercury	09/04/13	0836-1048	1-I-M29-1
			09/04/13	1109-1324	1-I-M29-2
			09/04/13	1348-1601	1-I-M29-3
Unit 1 FF Outlet	EPA M26A	Ammonia, HCl, and HF	09/04/13	0907-1019	1-O-M26A-1
			09/04/13	1140-1255	1-O-M26A-2
			09/04/13	1419-1532	1-O-M26A-3
	EPA M316	Formaldehyde	08/27/13	0904-1015	1-O-M316-1
			08/27/13	1220-1329	1-O-M316-2
			08/27/13	1518-1624	1-O-M316-3
	EPA M29	Particulate and Metals	09/04/13	0836-1048	1-O-M29-1
			09/04/13	1109-1324	1-O-M29-2
			09/04/13	1348-1601	1-O-M29-3
	EPA M201A	PM10	08/29/13	1506-1706	1-O-M201A-1
			08/30/13	0753-0957	1-O-M201A-2
			08/30/13	1023-1218	1-O-M201A-3
	EPA M8	Sulfuric Acid Mist	08/27/13	1048-1156	1-O-M8-1
			08/27/13	1348-1454	1-O-M8-2
			08/27/13	1704-1809	1-O-M8-3
	EPA M25A	THC as Ethane	08/27/13	0904-1050	1-O-CEM-1,2,3
			08/27/13	1104-1245	1-O-CEM-4,5,6
			08/27/13	1302-1451	1-O-CEM-7,8,9
	Facility COMS	Opacity	09/04/13	0900-1000	1-O-COMS-1
			09/04/13	1200-1300	1-O-COMS-2
			09/04/13	1400-1500	1-O-COMS-3
Ash Handling System	EPA M22	Fugitive Emissions	09/04/13	0845-0955	M22-1
			09/04/13	1010-1120	M22-2
			09/04/13	1430-1540	M22-3

**Table 1-3
Unit 2 Test Sequence**

Test Location	Sampling Method	Flue Gas Parameter	Run Date	Run Time	Run Number
Unit 2 SDA Inlet	EPA M26A	Hydrogen Chloride	09/06/13	0848-1000	2-I-M26-1
			09/06/13	1127-1238	2-I-M26-2
			09/06/13	1358-1507	2-I-M26-3
	EPA M29	Mercury	09/06/13	0817-1029	2-I-M29-1
			09/06/13	1050-1307	2-I-M29-2
			09/06/13	1322-1536	2-I-M29-3
Unit 2 FF Outlet	EPA M26A	Ammonia, HCl, and HF	09/06/13	0848-1000	2-O-M26A-1
			09/06/13	1127-1238	2-O-M26A-2
			09/06/13	1358-1507	2-O-M26A-3
	EPA M316	Formaldehyde	08/28/13	0947-1052	2-O-M316-1
			08/28/13	1358-1539	2-O-M316-2
			08/28/13	1718-1822	2-O-M316-3
	EPA M29	Particulate and Metals	09/06/13	0817-1029	2-O-M29-1
			09/06/13	1050-1307	2-O-M29-2
			09/06/13	1322-1536	2-O-M29-3
	EPA M201A	PM10	08/27/13	1240-1450	2-O-M201A-2
			08/27/13	1544-1750	2-O-M201A-3
			08/29/13	0854-1108	2-O-M201A-4
	EPA M8	Sulfuric Acid Mist	08/28/13	1109-1214	2-O-M8-1
			08/28/13	1232-1336	2-O-M8-2
			08/28/13	1559-1703	2-O-M8-3
	EPA M25A	THC as Ethane	08/28/13	0947-1134	2-O-CEM-1,2,3
			08/28/13	1150-1336	2-O-CEM-4,5,6
			08/28/13	1406-1551	2-O-CEM-7,8,9
	Facility COMS	Opacity	09/06/13	0900-1000	2-O-COMS-1
			09/06/13	1100-1200	2-O-COMS-2
			09/06/13	1400-1500	2-O-COMS-3

**Table 1-4
Unit 3 Test Sequence**

Test Location	Sampling Method	Flue Gas Parameter	Run Date	Run Time	Run Number
Unit 3 SDA Inlet	EPA M26A	Hydrogen Chloride	09/05/13	0841-1002	3-I-M26-1
			09/05/13	1118-1232	3-I-M26-2
			09/05/13	1401-1513	3-I-M26-3
	EPA M29	Mercury	09/05/13	0810-1026	3-I-M29-1
			09/05/13	1047-1301	3-I-M29-2
			09/05/13	1330-1542	3-I-M29-3
Unit 3 FF Outlet	EPA M26A	Ammonia, HCl, and HF	09/05/13	0841-1002	3-O-M26A-1
			09/05/13	1118-1232	3-O-M26A-2
			09/05/13	1401-1513	3-O-M26A-3
	EPA M23	Dioxins/Furans, PAHs, and PCBs	08/27/13	0830-1252	3-O-M23-1
			08/27/13	1317-1721	3-O-M23-2
			08/28/13	0812-1224	3-O-M23-3
	EPA M316	Formaldehyde	08/29/13	0928-1032	3-O-M316-1
			08/29/13	1154-1258	3-O-M316-2
			08/29/13	1416-1519	3-O-M316-3
	EPA M29	Particulate and Metals	09/05/13	0810-1026	3-O-M29-1
			09/05/13	1047-1301	3-O-M29-2
			09/05/13	1330-1542	3-O-M29-3
	EPA M201A	PM10	08/28/13	0831-1036	3-O-M201A-1
			08/28/13	1144-1348	3-O-M201A-2
			08/28/13	1352-1559	3-O-M201A-3
	EPA M8	Sulfuric Acid Mist	08/29/13	0815-0922	3-O-M8-1
			08/29/13	1042-1147	3-O-M8-2
			08/29/13	1307-1412	3-O-M8-3
	EPA M25A	THC as Ethane	08/29/13	0803-0952	3-O-CEM-1,2,3
			08/29/13	1007-1151	3-O-CEM-4,5,6
			08/29/13	1205-1350	3-O-CEM-7,8,9
	Facility COMS	Opacity	09/05/13	0900-1000	3-O-COMS-1
			09/05/13	1100-1200	3-O-COMS-2
			09/05/13	1400-1500	3-O-COMS-3

**Table 1-5
Utilization of EPA Method 2 and 3 Data**

Runs Requiring Additional Information	Runs Providing Air Flow Rate Data	Runs Providing Flue Gas Composition Data
1-I-M26-1	NA	1-I-M29-1
1-I-M26-2	NA	1-I-M29-2
1-I-M26-3	NA	1-I-M29-3
1-O-M26A-1	NA	1-O-M29-1
1-O-M26A-2	NA	1-O-M29-2
1-O-M26A-3	NA	1-O-M29-3
1-O-CEM-1,2,3	1-O-M316-1, 1-O-M316-1, 1-O-M8-1	NA
1-O-CEM-4,5,6	1-O-M8-1, 1-O-M8-1, 1-O-M316-2	NA
1-O-CEM-7,8,9	1-O-M316-2, 1-O-M8-2, 1-O-M8-2	NA
2-I-M26-1	NA	2-I-M29-1
2-I-M26-2	NA	2-I-M29-2
2-I-M26-3	NA	2-I-M29-3
2-O-M26A-1	NA	2-O-M29-1
2-O-M26A-2	NA	2-O-M29-2
2-O-M26A-3	NA	2-O-M29-3
2-O-CEM-1,2,3	2-O-M316-1, 2-O-M316-1, 2-O-M8-1	NA
2-O-CEM-4,5,6	2-O-M8-1, 2-O-M8-2, 2-O-M8-2	NA
2-O-CEM-7,8,9	2-O-M316-2, 2-O-M316-3, 2-O-M316-2	NA
3-I-M26-1	NA	3-I-M29-1
3-I-M26-2	NA	3-I-M29-2
3-I-M26-3	NA	3-I-M29-3
3-O-M26A-1	NA	3-O-M29-1
3-O-M26A-2	NA	3-O-M29-2
3-O-M26A-3	NA	3-O-M29-3
3-O-CEM-1,2,3	3-O-M8-1, 3-O-M8-1, 3-O-M316-1	NA
3-O-CEM-4,5,6	3-O-M316-1, 3-O-M8-2, 3-O-M8-2	NA
3-O-CEM-7,8,9	3-O-M316-2, 3-O-M316-2, 3-O-M8-3	NA

2.0 SUMMARY OF RESULTS

2.1 Report Organization

The results of the testing project are summarized in Section 2. The process tested is discussed in Section 3. The sampling and analytical methods utilized are discussed in Section 4 while the Quality Assurance/Quality Control results are presented in Section 5. Appendix A contains detailed results of the testing program. Appendix B contains the field data that was collected and Appendix C contains the analytical results. Appendix D contains all pertinent testing equipment calibration data. Appendix E contains the data sheets of aborted test runs. Refer to the Table of Contents and the List of Tables and Figures for a complete reference with appropriate page numbers.

2.2 Presentation of Results

Table 2-1 presents the results of the emissions testing project for Unit 1 while Table 2-2 presents the results of the emissions testing project for Unit 2 and Table 2-3 presents the results of the emissions testing project for Unit 3. A more detailed summary of the sampling gas parameters is presented in Appendix A.

2.3 Facility COM Data

Continuous Opacity Monitoring (COM) data for opacity was provided by the facility as per 40CFR 60.11 (e) (5). This data is contained in Appendix B.

2.4 Fugitive Emissions Results

Fugitive emissions measurements were taken along the ash discharge system and at the ash loading area. No periods of visible fugitive emissions were observed during the observation period. The field data sheets are located in Appendix B.

2.5 Carbon Monoxide, Sulfur Dioxide, and Nitrogen Oxides

Carbon monoxide, sulfur dioxide, and nitrogen oxides data (provided by the facility CEMs) was used along with the concurrent EPA Method 29 air flow rates to calculate the three one-hour pounds/hour averages.

2.6 Voided Test Runs

Test run 2-O-M201A-1 did not meet the posttest leak check criteria and was therefore voided. An additional test run designated as 2-O-M201A-2 was conducted to provide the required three test runs per parameter. The data sheet for the voided test run is included in Appendix E.

2.7 Dioxins/Furans Results and EMPC Values

In accordance with EPA Method 23, Section 9.9, all dioxins/furans results that were below the minimum detection limit (ND) were treated as zero when averaging or totaling the results. All dioxins/furans results that were an estimated maximum possible concentration (EMPC) are presented using the EMPC value as a positive catch when calculating the results.

2.8 Metals Results

The metals results are presented using a worst case scenario. All non-detected values were considered as positive catches when totaling the analytical fractions. Any result that includes a non-detected value includes a "<" symbol in front of the result. Additionally, the results were not corrected for the blank values that were detected in the reagent blank.

2.9 Non-detected Values

The results are presented using a worst-case scenario. All non-detected results were used as values for calculation purposes and the result is preceded by a "<" symbol. All non-detected results were used as positive catches when calculating total catch weights for samples that had both a positive catch weight for one or more fractions and also non-detected fraction(s). When averaging across a set of three test runs, non-detected results were treated as values. Any average result that includes a non-detected value includes a "<" symbol in front of the result.

2.10 Duplicate Analyses

Runs 1-O-M29-2, 2-O-M29-2, and 3-O-M29-2 were analyzed in duplicate for metals. All samples for mercury were analyzed in duplicate. All samples for hydrogen chloride were analyzed in duplicate. The average of the duplicate analyses were used for reporting purposes.

2.11 Sulfuric Acid Mist Results

The Source Test Plan submitted to the New York Department of Environmental Protection for pre-test approval requested a method modification to analyze the sulfuric acid mist samples using ion chromatography rather than the Thorin titration per EPA Method 8. Ion chromatography is more accurate because it avoids interferences that are inherent in the titration procedure. Mr. Gary McAlister of the USEPA has stated his "technical opinion that analyzing EPA Method 8 samples for sulfuric acid mist by IC is as accurate as analyzing the samples by the Thorin titrations as specified in EPA Method 8". Ion chromatography results were utilized for subsequent calculations in this report.

2.12 PCB Results

All PCB results that were below the minimum detection limit (ND) or were an estimated maximum possible concentration (EMPC, ~) were treated as positive catches when averaging or totaling the results.

2.13 PAH Results

Certain PAHS, naphthalene and some naphthalene analogs (acenaphthene and 2-methylnaphthalene) are artifacts of the XAD-2 resin manufacturing process. The difficulties in completely removing these PAHs from the XAD-2 resin and further potential artifact production during the analytical procedures preclude reliable PAH results. Therefore, results presented in this report do not include the contribution from naphthalene and its derivatives (acenaphthene and 2-methylnaphthalene). A complete data set can be found in Appendix A.

All PAH results that were below the minimum detection limit (ND) were treated as positive catches when averaging or totaling the results.

**Table 2-1
Unit 1 Summary of Emissions**

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limits
Fugitive Emissions					
Fugitive Emissions, % of time	0.0	0.0	0.0	0.0	5%
Unit 1 SDA Inlet Concentrations					
Hydrogen Chloride, ppm @ 7% O ₂	571	652	624	616	NA
Mercury, ug/DSCM @ 7% O ₂	269	< 33.2	< 52.0	< 118	NA
Unit 1 FF Outlet Concentrations					
Ammonia, ppm @ 7% O ₂	9.04	10.5	16.8	12.1	50
Carbon Monoxide, ppm @ 7% O ₂ ¹	22	---	---	22	100
Formaldehyde, ng/DSCM @ 7% O ₂	< 23,400	<13,800	<15,300	<17,500	1.03E+05
Hydrogen Chloride, ppm @ 7% O ₂	0.845	1.17	1.19	1.07	29 ^b
Mercury, ug/DSCM @ 7% O ₂	< 1.33	< 1.37	< 1.32	< 1.34	28 ^b
Metals					
Cadmium, ug/DSCM @ 7% O ₂	1.49	0.271	0.410	0.725	35
Lead, ug/DSCM @ 7% O ₂	15.5	4.48	6.73	8.90	400
Nitrogen Oxides, ppm @ 7% O ₂ ²	114	---	---	114	185
Opacity, % ³	0.5	0.6	0.7	0.6	10%
Particulate, Gr/DSCF @ 7% O ₂	0.000640	0.000200	0.000737	0.000526	0.010
Particulate, mg/DSCM @ 7% O ₂	1.46	0.457	1.69	1.20	25
PM10, Gr/DSCF @ 7% O ₂	0.000705	0.000351	0.000224	0.000427	0.010
Sulfur Dioxide, ppm @ 7% O ₂ ⁴	1	---	---	1	29 ^b

¹ – 4 hour block average (from Facility CEMs)

² – 24 hour arithmetic average (from Facility CEMs)

³ – COMs readings were used to demonstrate compliance with the opacity standard in lieu of EPA Method 9 as per 40CFR60.11(e)(5) (from Facility COMs)

⁴ – 24 hour geometric average (from Facility CEMs)

⁵ – Permit limits for hydrogen chloride, mercury, and sulfur dioxide are based on concentration or removal efficiency, whichever is less stringent.

**Table 2-1
Unit 1 Summary of Emissions
(continued)**

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limits
Unit 1 FF Outlet Emission Rates, lbs/hr					
Carbon Monoxide ¹	4.3	3.8	3.1	3.8	15.9
Hydrogen Chloride	0.182	0.235	0.243	0.220	10.3
Hydrogen Fluoride	<0.00918	<0.00880	<0.00894	<0.00897	0.73
Mercury	<0.000189	<0.000185	<0.000180	<0.000185	0.05
Metals					
Arsenic	3.19E-05	2.51E-05	2.87E-05	2.86E-05	1.2E-03
Beryllium	<4.96E-06	<5.13E-06	<5.01E-06	<5.03E-06	0.0002
Cadmium	2.12E-04	3.65E-05	5.60E-05	1.02E-04	1.5E-03
Chromium	4.70E-04	3.27E-04	4.94E-04	4.30E-04	1.2E-03
Lead	2.20E-03	6.03E-04	9.20E-04	1.24E-03	0.28
Manganese	7.75E-04	5.15E-04	5.43E-04	6.11E-04	8.6E-03
Nickel	7.59E-04	4.22E-04	5.82E-04	5.88E-04	8.2E-04
Vanadium	<1.98E-05	<2.05E-05	<2.00E-05	<2.01E-05	2.0E-04
Zinc	8.96E-03	4.79E-03	4.43E-03	6.06E-03	8.6E-02
Total Hydrocarbons (VOC), as ethane ²	0.053	0.095	0.053	0.067	6.4
Nitrogen Oxides ¹	29.1	29.5	30.7	29.8	NA
Sulfur Dioxide ¹	0.0	0.0	0.0	0.0	32.6
Sulfuric Acid Mist	<0.00761	<0.00631	<0.00681	<0.00691	2.04
Unit 1 Removal Efficiency %					
HCl, ppm @ 7% O ₂	99.9	99.8	99.8	99.8	>95% ³
Mercury, ug/DSCM @ 7% O ₂	99.5	95.9	97.5	97.6	>85% ³
SO ₂ , ppm @ 7% O ₂ ⁴	100	---	---	100	>75% ³

¹ – Three one-hour averages calculated from Facility CEMs ppmvd and EPA Method 29 air flow rates

² – Three 24-minute test runs were combined to represent one 72-minute VOC test run.

³ – Permit limits for hydrogen chloride, mercury, and sulfur dioxide are based on concentration or removal efficiency, whichever is less stringent.

⁴ – 24 hour geometric average (from Facility CEMs)

**Table 2-2
Unit 2 Summary of Emissions**

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limits
Unit 2 SDA Inlet Concentrations					
Hydrogen Chloride, ppm @ 7% O ₂	604	1078	733	805	NA
Mercury, ug/DSCM @ 7% O ₂	< 48.5	< 43.2	< 137	< 76.3	NA
Unit 2 FF Outlet Concentrations					
Ammonia, ppm @ 7% O ₂	2.98	2.87	2.66	2.84	50
Carbon Monoxide, ppm @ 7% O ₂ ¹	17	---	---	17	100
Formaldehyde, ng/DSCM @ 7% O ₂	<11,900	<14,000	<12,500	<12,800	1.03E+05
Hydrogen Chloride, ppm @ 7% O ₂	1.06	1.72	1.66	1.48	29 ^b
Mercury, ug/DSCM @ 7% O ₂	< 3.22	< 1.41	< 1.33	< 1.98	28 ^b
Metals					
Cadmium, ug/DSCM @ 7% O ₂	0.231	0.227	0.207	0.222	35
Lead, ug/DSCM @ 7% O ₂	3.55	2.62	3.01	3.06	400
Nitrogen Oxides, ppm @ 7% O ₂ ²	113	---	---	113	185
Opacity, % ³	0.0	0.0	0.1	0.0	10%
Particulate, Gr/DSCF @ 7% O ₂	0.000734	0.000377	0.000290	0.000467	0.010
Particulate, mg/DSCM @ 7% O ₂	1.68	0.862	0.663	1.07	25
PM10, Gr/DSCF @ 7% O ₂	0.000301	0.000583	0.000285	0.000390	0.010
Sulfur Dioxide, ppm @ 7% O ₂ ⁴	1	---	---	1	29 ^b

¹ – 4 hour block average (from Facility CEMs)

² – 24 hour arithmetic average (from Facility CEMs)

³ – COMs readings were used to demonstrate compliance with the opacity standard in lieu of EPA Method 9 as per 40CFR60.11(e)(5) (from Facility COMs)

⁴ – 24 hour geometric average (from Facility CEMs)

⁵ – Permit limits for hydrogen chloride, mercury, and sulfur dioxide are based on concentration or removal efficiency, whichever is less stringent.

Table 2-2
Unit 2 Summary of Emissions
(continued)

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limits
Unit 2 FF Outlet Emission Rates, lbs/hr					
Carbon Monoxide ¹	2.4	3.0	3.0	2.8	15.9
Hydrogen Chloride	0.190	0.341	0.315	0.282	10.3
Hydrogen Fluoride	<0.00860	<0.00818	<0.00839	<0.00839	0.73
Mercury	<3.83E-04	<1.72E-04	<1.73E-04	<2.42E-04	0.05
Metals					
Arsenic	2.17E-05	1.98E-05	<1.92E-05	<2.02E-05	1.2E-03
Beryllium	<4.75E-06	<4.78E-06	<4.80E-06	<4.78E-06	0.0002
Cadmium	2.75E-05	2.77E-05	2.70E-05	2.74E-05	1.5E-03
Chromium	3.20E-04	3.56E-04	2.87E-04	3.21E-04	1.2E-03
Lead	4.22E-04	3.20E-04	3.92E-04	3.78E-04	0.28
Manganese	3.03E-04	5.13E-04	2.44E-04	3.53E-04	8.6E-03
Nickel	5.92E-04	4.61E-04	3.20E-04	4.58E-04	8.2E-04
Vanadium	<1.90E-05	<1.91E-05	<1.92E-05	<1.91E-05	2.0E-04
Zinc	3.75E-03	3.41E-03	2.79E-03	3.32E-03	8.6E-02
Total Hydrocarbons (VOC), as ethane ²	0.083	0.022	0.026	0.044	6.4
Nitrogen Oxides ¹	30.0	28.0	28.6	28.9	NA
Sulfur Dioxide ¹	0.5	0.5	0.5	0.5	32.6
Sulfuric Acid Mist	<0.00626	<0.00603	<0.00853	<0.00694	2.04
Unit 2 Removal Efficiency %					
HCl, ppm @ 7% O ₂	99.8	99.8	99.8	99.8	>95% ³
Mercury, ug/DSCM @ 7% O ₂	93.4	96.7	99.0	96.4	>85% ³
SO ₂ , ppm @ 7% O ₂ ⁴	100	---	---	100	>75% ³

¹ – Three one-hour averages calculated from Facility CEMs ppmvd and EPA Method 29 air flow rates

² – Three 24-minute test runs were combined to represent one 72-minute VOC test run.

³ – Permit limits for hydrogen chloride, mercury, and sulfur dioxide are based on concentration or removal efficiency, whichever is less stringent.

⁴ – 24 hour geometric average (from Facility CEMs)

**Table 2-3
Unit 3 Summary of Emissions**

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limits
Unit 3 SDA Inlet Concentrations					
Hydrogen Chloride, ppm @ 7% O ₂	732	629	795	719	NA
Mercury, ug/DSCM @ 7% O ₂	< 93.5	< 27.8	< 27.1	< 49.5	NA
Unit 3 FF Outlet Concentrations					
Ammonia, ppm @ 7% O ₂	4.36	4.25	4.25	4.29	50
Carbon Monoxide, ppm @ 7% O ₂ ¹	15	---	---	15	100
2,3,7,8-TCDD, ng/DSCM @ 7% O ₂ (NYTEQ)	0.0535	0.0197	0.0199	0.0311	0.61
Dioxins/Furans, ng/DSCM @ 7% O ₂	2.30	1.35	1.21	1.62	30
Formaldehyde, ng/DSCM @ 7% O ₂	<14,600	<14,200	<14,900	<14,600	1.03E+05
Hydrogen Chloride, ppm @ 7% O ₂	1.65	2.04	2.87	2.19	29 ^b
Mercury, ug/DSCM @ 7% O ₂	< 1.29	< 1.45	< 1.44	< 1.39	28 ^b
Metals					
Cadmium, ug/DSCM @ 7% O ₂	0.256	0.359	0.294	0.303	35
Lead, ug/DSCM @ 7% O ₂	3.62	8.88	3.76	5.42	400
Nitrogen Oxides, ppm @ 7% O ₂ ²	113	---	---	113	185
Opacity, % ³	0.0	0.0	0.0	0.0	10%
Particulate, Gr/DSCF @ 7% O ₂	0.000532	0.000737	0.000699	0.000656	0.010
Particulate, mg/DSCM @ 7% O ₂	1.22	1.69	1.60	1.50	25
PAHs, ng/DSCM @ 7% O ₂	5.80E+02	4.48E+02	<4.82E+02	<5.03E+02	8.77E+03
PCBs, ng/DSCM @ 7% O ₂	2.66E+01	1.36E+01	3.07E+01	2.36E+01	3.88E+03
PM10, Gr/DSCF @ 7% O ₂	0.000628	0.000403	0.000565	0.000532	0.010
Sulfur Dioxide, ppm @ 7% O ₂ ⁴	1	---	---	1	29 ^b

¹ – 4 hour block average (from Facility CEMs)

² – 24 hour arithmetic average (from Facility CEMs)

³ – COMs readings were used to demonstrate compliance with the opacity standard in lieu of EPA Method 9 as per 40CFR60.11(e)(5) (from Facility COMs)

⁴ – 24 hour geometric average (from Facility CEMs)

⁵ – Permit limits for hydrogen chloride, mercury, and sulfur dioxide are based on concentration or removal efficiency, whichever is less stringent.

**Table 2-3
Unit 3 Summary of Emissions
(continued)**

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limits
Unit 3 FF Outlet Emission Rates, lbs/hr					
Carbon Monoxide ¹	2.4	2.4	2.4	2.4	15.9
Hydrogen Chloride	0.332	0.364	0.512	0.403	10.3
Hydrogen Fluoride	<0.00863	<0.00853	<0.00898	<0.00871	0.73
Mercury	<1.74E-04	<1.72E-04	<1.72E-04	<1.73E-04	0.05
Metals					
Arsenic	2.30E-05	2.99E-05	2.20E-05	2.50E-05	1.2E-03
Beryllium	<4.82E-06	<4.78E-06	<4.78E-06	<4.79E-06	0.0002
Cadmium	3.44E-05	4.27E-05	3.52E-05	3.74E-05	1.5E-03
Chromium	3.52E-04	3.37E-04	3.31E-04	3.40E-04	1.2E-03
Lead	4.87E-04	1.06E-03	4.49E-04	6.64E-04	0.28
Manganese	4.50E-04	4.16E-04	3.86E-04	4.17E-04	8.6E-03
Nickel	4.43E-04	3.66E-04	4.41E-04	4.16E-04	8.2E-04
Vanadium	<1.93E-05	<1.91E-05	<1.91E-05	<1.92E-05	2.0E-04
Zinc	3.75E-03	3.53E-03	3.61E-03	3.63E-03	8.6E-02
Total Hydrocarbons (VOC), as ethane ²	0.024	0.028	0.029	0.027	6.4
Nitrogen Oxides ¹	30.7	29.3	29.6	29.9	NA
Sulfur Dioxide ¹	0.0	0.0	0.0	0.0	32.6
Sulfuric Acid Mist	<0.00869	<0.00657	<0.00732	<0.00753	2.04
Unit 3 Removal Efficiency %					
HCl, ppm @ 7% O ₂	99.8	99.7	99.6	99.7	>95% ³
Mercury, ug/DSCM @ 7% O ₂	98.6	94.8	94.7	96.0	>85% ³
SO ₂ , ppm @ 7% O ₂ ⁴	100	---	---	100	>75% ³

¹ – Three one-hour averages calculated from Facility CEMs ppmvd and EPA Method 29 air flow rates

² – Three 24-minute test runs were combined to represent one 72-minute VOC test run.

³ – Permit limits for hydrogen chloride, mercury, and sulfur dioxide are based on concentration or removal efficiency, whichever is less stringent.

⁴ – 24 hour geometric average (from Facility CEMs)

3.0 PROCESS DESCRIPTION AND OPERATION

The Huntington Resource Recovery Facility processes up to 350,400 tons of solid waste each year, generating up to 27.5 megawatts of electricity. The facility was designed and built and is owned and operated by Covanta Projects, of Huntington, Inc. Each of the three (3) Martin GmbH waterwall furnaces has a nominal design capacity of 250 tons of waste per day. Waste is combusted at furnace temperatures exceeding 1,800 degrees Fahrenheit and reduced to an inert ash residue. Before leaving the facility, combustion air is directed through technologically advanced air pollution control equipment consisting of spray dryer absorbers (SDA) and fabric filter (FF) baghouses. Each boiler is also equipped with an ammonia-based selective non-catalytic reduction (SNCR) system for control of NOx emissions and dry activated carbon injection to reduce mercury emissions.

4.0 SAMPLING AND ANALYTICAL METHODS

This section briefly describes the sampling and analytical procedures that were used and any deviations from the methods. Figure 4-1 depicts cross-sections of the SDA Inlet test location and Figure 4-2 depicts cross-sections of the FF Outlet test location.

4.1 EPA Methods 1-4

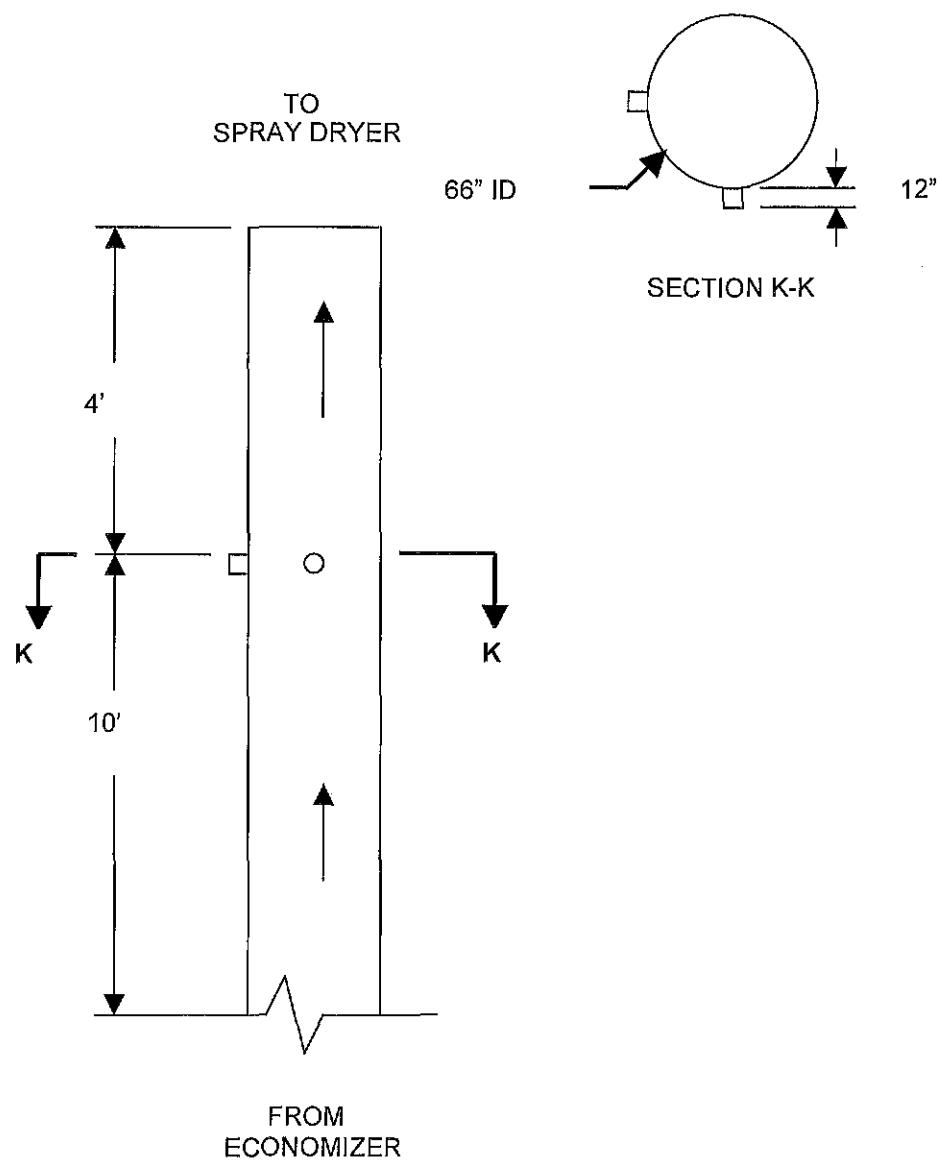
EPA Methods 1 through 4 were utilized in conjunction with each isokinetic test method. EPA Method 1 was used to determine the location of the sampling points. EPA Method 2 was used to measure the flue gas flow rate. EPA Method 3 was used to determine the flue gas molecular weight. EPA Method 4 was used to determine the flue gas moisture content. The information provided by these methods was used in determining isokinetics, parameter concentrations, and parameter emission rates.

4.2 EPA Method 8 – Sulfuric Acid Mist

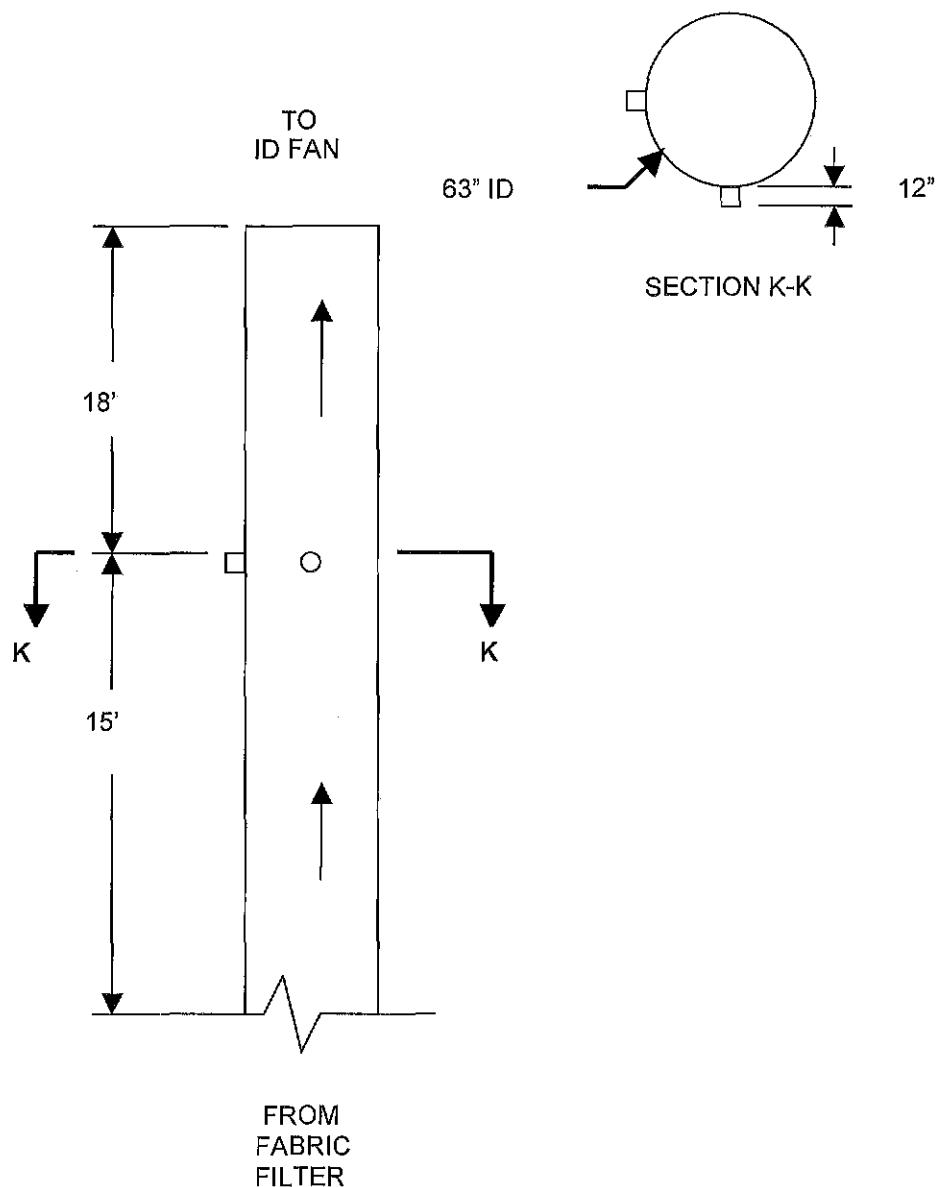
Sulfuric acid mist concentrations and emission rates were determined utilizing EPA Method 8. The EPA Method 8 sampling train consisted of a glass nozzle, a heated glass probe, a heated glass mat filter, one chilled impinger with 100mL of 80% IPA, an unheated glass mat filter, two chilled impingers each with 100mL of 3% H₂O₂, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 8 with no exceptions.

At the end of each test run, the contents of the IPA impinger was poured back into the original IPA reagent jar. The contents of the H₂O₂ impingers were poured back into the original H₂O₂ reagent jar. The silica gel was returned to its original container. The moisture catch in the components was then determined gravimetrically. The nozzle, probe, and filter fronthalf were rinsed with IPA into a sample jar. The heated filter was placed into this sample jar. The filter backhalf, IPA impinger, fronthalf of the second filter, connecting glassware, and the second filter itself were rinsed with DI water into the IPA reagent jar. The backhalf of the second filter, the H₂O₂ impingers, and connecting glassware were rinsed with DI water into the H₂O₂ reagent jar.

The fronthalf portion of the samples was analyzed in accordance with EPA Method 8 for sulfate as sulfuric acid mist using ion chromatography and titrations techniques. The ion chromatography results were utilized in subsequent calculations. The titration results are included in the analytical results for reference.



**Figure 4-1. SDA Inlet Sampling Location
(Units 1, 2, & 3 are identical)**



**Figure 4-2. Fabric Filter Outlet Sampling Location
(Units 1, 2, & 3 are identical)**

4.3 EPA Method 22 – Fugitive Emissions

The accumulated emissions time of fugitive emissions was determined by observing the process area(s) during normal operations for a pre-determined observation period (three, one-hour test runs). This method does not require that the opacity of emissions be determined, but rather the length of time that any fugitive emissions are visible. Fugitive emissions include emissions that escape capture by exhaust hoods, that are emitted during material transfer, that are emitted from buildings housing material processing or handling equipment, or that are emitted directly from process equipment. If any fugitive emissions are observed during the observation period, the length of time that the emissions are visible is quantified using a stopwatch. This total accumulated time of fugitive emissions is then used to determine compliance with the subpart or permit.

4.4 EPA Method 23/Alternate Method 052 – Dioxins/Furans

The concentrations and emissions rates of polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDD/PCDF or dioxins/furans), Polyaromatic Hydrocarbons (PAHs), and Polychlorinated Biphenyls (PCBs) were determined utilizing EPA Method 23. The EPA Method 23 sampling train consisted of a glass nozzle, a heated glass probe, a heated glassmat filter, a condenser, an XAD resin trap, an empty impinger, two chilled impingers each with 100mL of DI water, an empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 23 except methylene chloride was not used as a rinse solvent.

At the end of each test run, the nozzle, probe, and filter fronthalf were rinsed with acetone into a sample jar. The filter was recovered dry into a glass petri dish. The filter backhalf, and condenser were rinsed with acetone into the sample jar. All of the components listed above up to the XAD resin trap were rinsed again with toluene into another sample jar. The XAD resin trap was sealed and placed into a chilled ice chest. The contents of the first three impingers were poured back into the original reagent jar. The silica gel was poured back into its original container. The impingers were rinsed with acetone into another sample jar. The moisture catch was then determined gravimetrically.

The samples were analyzed in accordance with EPA Method 23 and Alternate Method 052 for dioxins/furans, SW846 Method 1668A for PCBs, and CARB Method 429 for PAHs.

4.5 EPA Method 26 (Modified) – Hydrogen Chloride

Hydrogen chloride concentrations and emission rates were determined at the SDA Inlet utilizing EPA Method 26 modified to use large impingers. The EPA Method 26 sampling train consisted of a heated glass probe, a heated quartz filter, two chilled impingers each with 100mL of

0.1N H₂SO₄, an empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 26 except that large impingers were used for sample collection.

At the end of each test run, the contents of the H₂SO₄ impingers were poured back into the original H₂SO₄ reagent jar. The contents of the DI impingers were poured back into the original jar. The silica gel was returned to its original container. The moisture catch in the components was determined gravimetrically. The filter backhalf and H₂SO₄ impingers were rinsed with DI water into the H₂SO₄ reagent jar. The DI impingers were rinsed with DI water into the DI reagent jar.

The H₂SO₄ portion of the samples were analyzed in accordance with EPA Method 26 for hydrogen chloride.

4.6 *EPA Method 26A – Ammonia, Hydrogen Chloride, and Hydrogen Fluoride*

Hydrogen chloride, hydrogen fluoride, and ammonia concentrations and emission rates were determined at the FF Outlet utilizing EPA Method 26A. The EPA Method 26A sampling train consisted of a glass nozzle, a heated glass probe, a heated quartz filter, two chilled impingers each with 100mL of 0.1N H₂SO₄, an empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 26A.

At the end of each test run, the contents of the impingers were poured back into the original H₂SO₄ reagent jar. The silica gel was returned to its original container. The moisture catch in the components was determined gravimetrically. The filter backhalf and impingers were rinsed with DI water into the H₂SO₄ reagent jar.

The H₂SO₄ portion of the samples were analyzed in accordance with EPA Method 26A for hydrogen chloride and hydrogen fluoride. The H₂SO₄ portion of the samples were also analyzed for ammonia using ion chromatography techniques.

4.7 *EPA Method 29 – Particulate and Metals*

Particulate and metals concentrations and emission rates were determined utilizing EPA Method 29. The EPA Method 29 sampling train consisted of a glass nozzle, a heated glass probe, a heated tared quartz filter, two chilled impingers each with 100mL of 5%HNO₃/10%H₂O₂, an empty impinger, two chilled impingers each with 100mL of 4%KMnO₄/10%H₂SO₄, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 29 with no exceptions.

At the end of each test run, the nozzle, probe, and filter fronthalf were rinsed with 100 mL of acetone into a sample bottle. The nozzle, probe, and filter fronthalf were rinsed again with 100 mL of 0.1N nitric acid into a sample jar. The filter was recovered dry into another sample bottle. The

contents of the 5% HNO_3 /10% H_2O_2 impingers were poured back into the original reagent jar. Any condensate in the empty impinger was poured into a sample bottle. The 4% KMnO_4 /10% H_2SO_4 impingers were recovered into another sample jar.

The moisture catch was then determined gravimetrically. The filter backhalf and 5% HNO_3 /10% H_2O_2 impingers were rinsed with 100 mL of 0.1N nitric acid into the reagent jar. The empty impinger was rinsed with 100 mL of 0.1N nitric acid into a sample jar. The 4% KMnO_4 /10% H_2SO_4 impingers were rinsed with 100 mL of 4% KMnO_4 /10% H_2SO_4 and 100 mL of DI water into the jar containing the 4% KMnO_4 /10% H_2SO_4 reagent. The 4% KMnO_4 /10% H_2SO_4 impingers and connecting glassware were rinsed with 25mL of 8N HCl if any brown residue remained. This HCl rinse was added to a jar containing 200mL of DI water.

The filter and acetone rinses were desiccated and analyzed gravimetrically following EPA Method 5 and 29 techniques. The samples were analyzed in accordance with EPA Method 29 for metals.

4.8 EPA Method 201A – PM10

PM10 concentrations and emission rates were determined utilizing EPA Method 201A. The EPA Method 201A sampling train consisted of a stainless steel nozzle, an in-stack cyclone and filter, a heated glass probe, a filter bypass, two impingers containing 100 mL of water each, a dry impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 201A. At the end of each test run, the contents of the first, second, and third impingers were returned to the original jar and measured volumetrically. The silica gel moisture weight gain was obtained gravimetrically. The condensate catch for the test run was determined and entered into moisture calculations. The nozzle and particulate greater than 10 microns portion of the cyclone was rinsed with acetone into a jar. The particulate less than 10 portion of the cyclone was rinsed with acetone into another jar. The filter was recovered dry into a jar. Twelve points (six points per axis on two axes) were each sampled for approximately ten (10) minutes for a total nominal sampling time of 120 minutes. Readings were taken approximately every ten (10) minutes.

The acetone rinses and filter were desiccated and analyzed gravimetrically to determine the particulate greater than and less than 10 microns fractions.

4.9 EPA Method 316 - Formaldehyde

Formaldehyde concentrations and emission rates were determined utilizing EPA Method 316. The EPA Method 316 sampling train consisted of a glass nozzle, a heated glass probe, a heated filter bypass, two chilled impingers each with 100mL of DI, an empty impinger, an impinger with 200 grams

of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 316 with no exceptions.

At the end of each test run, the contents of the first three impingers were poured back into the original reagent jar. The moisture catch was then determined gravimetrically. The nozzle, probe, filter bypass, first three impingers, and connecting glassware were rinsed with DI water and added to the DI reagent bottle. The moisture catch in the silica gel was determined gravimetrically. The samples will then be stored in a chilled ice chest for storage and transport.

The samples were analyzed in accordance with EPA Method 316 for formaldehyde.

4.10 EPA Methods 3A and 25A – Total Hydrocarbons

Oxygen, carbon dioxide, and total hydrocarbon concentrations were determined utilizing a continuous emissions monitoring (CEM) system as per EPA Methods 3A and 25A. This section presents the sample system description and operation. No deviations from EPA Methods were performed.

The CEM system consisted of an in stack probe, heated out of stack filter, heated transfer lines, condenser, heated Teflon sample lines, sample pump, distribution manifold board, analyzers, and calibration gases. All components of the sampling system that are in contact with the sample are constructed of Teflon, glass, or stainless steel (316). Flue gas was extracted from the source through a three-point stainless steel probe. Flue gas was then passed through a heated Teflon sample line to a tee where the sample was split. Part of the sample remained heated to the hydrocarbon analyzer while the remainder of the sample was diverted into a condenser. This filtering system removes interferences such as particulate and moisture. Conditioned flue gas was then transported via Teflon tubing to a Teflon lined sample pump, through a distribution manifold, and on to various analyzers.

The integrity of this sampling system was verified (as per EPA Methods) using EPA Protocol 1 calibration gases. The design of this sampling system allows the operator to introduce calibration gases at the outlet of the probe, prior to the heated out of stack filter (for the system bias check and calibration drift check), and directly into the analyzers (for linearity checks).

A CAI (California Analytical Instruments, Inc.) Model 300 HFID Heated Hydrocarbon Analyzer was utilized for quantifying total hydrocarbons. This model analyzer uses Flame Ionization Detection (FID) to determine the total hydrocarbon concentration (on a wet basis) within a gaseous sample. The analyzer has an adjustable heated oven which contains a heated pump and a burner in which a small flame is elevated and sustained by regulated flows of air and a mixture of hydrogen and helium. The burner jet is used as an electrode and is connected to the negative side of a precision power supply. An additional electrode, known as the 'collector', is connected to a high impedance, low noise electronic amplifier. The two electrodes establish an electrostatic field. When a gaseous sample is introduced to the burner, it is ionized in the flame and the electrostatic field causes the charged particles (ions) to migrate to their respective electrodes. The migration creates a small current

between the electrodes. This current is measured by the precision electrometer amplified and is directly proportional to the hydrocarbon concentration of the sample.

5.0 QA/QC RESULTS

5.1 QA/QC Policy Procedures

TESTAR Engineering is committed to adhering to Quality Assurance/Quality Control (QA/QC) procedures and objectives that meet or exceed the relevant EPA guidance. Our procedures include calibration of equipment as appropriate, proper glassware pre-cleaning to prevent contamination of samples, proper sample recovery, documented sample custody, blank samples, duplicate analyses, matrix spike recovery, and validated computer generated results. We also adhere to other method specific criteria such as maintaining isokinetic conditions during particulate type testing and posttest leak checks.

TESTAR Engineering uses oil manometers to determine velocity differential pressures thus eliminating potential errors from magnehelic gauges. The manometers are leveled and zeroed prior to taking any measurements. All equipment used onsite undergoes a pretest audit and operational check for accuracy. Dry gas meters are checked by using an orifice to determine the meter gamma. The audit gamma must be within 3% of the full test gamma for the meter to be acceptable. Likewise, all thermocouples are checked at ambient temperature versus an ASTM reference thermometer or a thermometer that has been checked against an ASTM reference thermometer. The reading must agree within 2°F. Additionally, the barometer is checked against a reference barometer prior to each project and must agree within 0.1" Hg.

After each testing project, the dry gas meter undergoes a posttest audit following the guidelines of Alternate Method 009. Alternate Method 009 utilizes a mathematical calculation to check the dry gas meter calibration factor (gamma) versus the full test calibration factor. The gamma must agree within $\pm 5\%$ of the full test gamma.

5.2 Sample Custody and Preservation

Proper sample custody and preservation techniques ensure that the samples collected and analyzed are the same, that the sample did not change in concentration prior to analysis, and that the sample was not tampered with prior to analysis. To ensure accurate results, TESTAR Engineering collects and transports samples in clean containers that are inert to the matrix enclosed, that will not contaminate the sample, and that prevent photochemical reactions when appropriate. All samples contain unique identifiers that include the client name, facility name, project number, collection date, unique run number, sample fraction, and matrix. Liquid levels are marked in order to determine if any leakage occurred during transport. Samples are accompanied by sample custody forms identifying the client, facility, project number, sample, fractions, collection date, etc. When custody is relinquished to the laboratory, the receiving sample custodian signs the form.

5.3 Sample Blanks, Duplicates, and Matrix Spikes

Several types of blanks are utilized depending upon the project QA objectives. Typical blanks include field blanks, reagent blanks, and trip blanks. Blanks help to identify the source of contamination if contamination is suspected based upon the result validation procedure. Trip blanks are typically not analyzed unless the field blank shows significant contamination. Field blanks and reagent blanks are analyzed during most testing programs involving metals unless requested not to do so by the client. Field blanks are analyzed during most programs involving organics such as dioxins/furans.

Duplicates and matrix spikes are analyzed for projects involving metals testing. At least 10% of the samples are analyzed in duplicate for metals and at least one matrix spike is performed. All mercury analyses are performed in duplicate.

Breakthrough analyses are performed for projects involving organics utilizing adsorbent tubes. Adsorbent tubes are desorbed and analyzed separately to determine if any breakthrough occurred. Breakthrough is said to have occurred if the organic catch weight on the last fraction (generally the backhalf of the last adsorbent tube) is more than 10% of the total train organic catch.

5.4 Data Validation and Presentation

The field test engineer is responsible for reviewing and validating data as it is obtained. Additionally the onsite project manager reviews data for consistency, completeness, and accuracy prior to leaving the site. This validation procedure is based upon their knowledge of the process being tested and/or similar sources as well as checks built into the software being utilized. This allows for error correction or for the testing to be repeated immediately rather than at a later undetermined date. The data undergoes another review by a Project Director upon return to headquarters. Analytical data is reviewed by the QA Director upon submittal by the analytical laboratory to resolve any conflicts or concerns as soon as possible rather than after the results have been calculated.

Data is collected using computerized spreadsheets in the field and the results are calculated using validated computer programs to prevent erroneous calculations.

5.5 QA/QC Results

This section presents QA/QC results from measures taken during the testing program. The results are summarized in the following tables for easy reference.

**Table 5-1
Summary of QA/QC Procedures**

Test Method	QA/QC Procedure	QA/QC Objective	QA/QC Results	Status of QA/QC
EPA M8	In-House SO4 Audit	< 10%	- 0.06 %	Acceptable
	In-House SO4 Spike	90 – 110 %	106.9 %	Acceptable
	IPA/Filter Blank	ND	< 0.043 mg	Acceptable
EPA M23	Internal Standard Recoveries (4-6)	40 – 130 %	81.3 – 103 %	Acceptable
	Internal Standard Recoveries (7-8)	25 – 130 %	72.4 – 93.2 %	Acceptable
	Surrogate Standard Recoveries	70 – 130 %	87 – 106 %	Acceptable
EPA M26A	HCl Reagent Blank	ND	< 0.086 mg	Acceptable
	HCl Spike	90 – 110 %	100.2 %	Acceptable
EPA M26A	HF Reagent Blank	ND	< 0.021 mg	Acceptable
	HF Spike	90 – 110 %	97.1 %	Acceptable
EPA M26A	NH3 Reagent Blank	ND	< 0.095 mg	Acceptable
	NH3 Spike	90 – 110 %	96.9 %	Acceptable
EPA M29	Acetone Blank	< 1.0E-5 mg/mg	2.03E-05 mg/mg	Acceptable, NO blank correction
EPA M29	Duplicate RPD	≤ 20 %	0 – 16.9 %	Acceptable
Arsenic	Reagent Blank	NA	< 0.2 ug	Acceptable
Beryllium	Reagent Blank	NA	< 0.05 ug	Acceptable
Cadmium	Reagent Blank	NA	< 0.2 ug	Acceptable
Chromium	Reagent Blank	NA	1.32 ug	Acceptable, NO blank correction
Lead	Reagent Blank	NA	0.728 ug	Acceptable, NO blank correction
Manganese	Reagent Blank	NA	1.02 ug	Acceptable, NO blank correction
Nickel	Reagent Blank	NA	0.960 ug	Acceptable, NO blank correction
Vanadium	Reagent Blank	NA	< 0.2 ug	Acceptable
Zinc	Reagent Blank	NA	3.17 ug	Acceptable, NO blank correction
Mercury	Spike Recoveries	75 – 125 %	70 – 121 %	Acceptable ¹
	Duplicate RPD	≤ 20 %	0 – 8.2 %	Acceptable
	Reagent Blank	ND	< 0.5 ug	Acceptable
EPA M201A	Spike Recoveries	75 – 125 %	84 – 113 %	Acceptable
	Acetone Blank	< 1.0E-5 mg/mg	4.47E-06 mg/mg	Acceptable
	Reagent Blank	ND	< 5.28 ug	Acceptable
	Field Blank	ND	< 14.0 ug	Acceptable
	In-House Audit	≤ 10 %	- 1.93 %	Acceptable

¹ Please refer to Appendix C.4 for further discussion.

APPENDIX A

Test Results

APPENDIX A.1
Test Results

Unit 1 SDA Inlet
Hydrogen Chloride

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

MM26

Client Name	Covanta Energy Group, Inc.	Operator	CAN
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 1 SDA Inlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number	1-I-MM26-1	1-I-MM26-2	1-I-MM26-3	
Run Date	09/04/13	09/04/13	09/04/13	
Run Start Time	hh:mm	907	1140	
Run Stop Time	hh:mm	1019	1255	

Sampling Parameters

Meter Calibration Factor	Y	1.0052	1.0052	1.0052	
Y _{QA} Calculated by Test Run	Y _{QA}	1.0212	1.0061	1.0040	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-3.30	-3.30	-3.30	-3.30
Barometric Pressure	in Hg	29.9	29.9	29.9	29.9
Carbon Dioxide Percentage	% CO ₂	9.5	9.0	9.2	9.2
Oxygen Percentage	% O ₂	10.2	10.8	10.5	10.5
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.3	80.2	80.3	80.3
Total Water Volume Collected	mL	146.5	132.6	131.5	136.9
Sample Volume	ft ³	42.277	43.070	43.295	42.881
Average Meter Temperature	°F	82	85	88	85
Average Delta H	in H ₂ O	1.40	1.40	1.40	1.40
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	6.896	6.241	6.190	6.442
Volume Metered @ STP	DSCF	41.520	42.069	41.996	41.861
Absolute Stack/Duct Pressure	in Hg	29.7	29.7	29.7	29.7
Absolute Meter Pressure	in Hg	30.0	30.0	30.0	30.0
Calculated Stack Moisture	% H ₂ O	14.2	12.9	12.8	13.3

Concentration and Emission Rate Data Summary

Hydrogen Chloride	mg	783	856	842	
Molecular Weight	MW	36.46	36.46	36.46	36.46
Concentration, ppm	ppm	439	474	467	460
Concentration, ppm @ 12% CO ₂	ppm@12%	555	632	609	599
Concentration, ppm @ 7% O ₂	ppm@7%	571	652	624	616

APPENDIX A.2
Test Results

Unit 1 SDA Inlet
Mercury

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M29

Client Name	Covanta Energy Group, Inc.			Operator	CAN
Plant Name	Huntington Resource Recovery Facility			Project #	13022
Sampling Location	Unit 1 SDA Inlet			Standard Temperature, °F	68
USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1		
Run Number		1-I-M29-1	1-I-M29-2	1-I-M29-3	SET AVERAGE
Run Date		09/04/13	09/04/13	09/04/13	
Run Start Time	hh:mm	836	1109	1348	
Run Stop Time	hh:mm	1048	1324	1601	

Sampling Parameters

Meter Calibration Factor	Y	0.9919	0.9919	0.9919	
Y _{OA} Calculated by Test Run	Y _{OA}	0.9757	0.9707	0.9702	
Y _{OA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-3.30	-3.30	-3.30	-3.30
Stack Cross-Sectional Area	ft ²	23.758	23.758	23.758	23.758
Barometric Pressure	in Hg	29.9	29.9	29.9	29.9
Actual Nozzle Diameter	in	0.236	0.231	0.236	
Carbon Dioxide Percentage	% CO ₂	9.5	9.0	9.2	9.2
Oxygen Percentage	% O ₂	10.2	10.8	10.5	10.5
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.3	80.2	80.3	80.3
Total Water Volume Collected	mL	257.5	195.7	226.0	226.4
Sample Volume	ft ³	68.417	65.953	69.540	67.970
Average Meter Temperature	°F	84	87	91	87
Average Stack Temperature	°F	405	403	409	406
Average Delta H	in H ₂ O	0.92	0.84	0.92	0.89
Total Sampling Time	min	120	120	120	120

Air Flow Parameters

Volume of Water vapor @ STP	SCF	12.121	9.212	10.638	10.657
Volume Metered @ STP	DSCF	65.993	63.163	66.224	65.127
Absolute Stack/Duct Pressure	in Hg	29.7	29.7	29.7	29.7
Absolute Meter Pressure	in Hg	30.0	30.0	30.0	30.0
Calculated Stack Moisture	% H ₂ O	15.5	12.7	13.8	14.0
Dry Mole Fraction	decimal	0.845	0.873	0.862	0.860
Avg Square of Differential Pressure	in H ₂ O	0.837	0.834	0.839	0.837
Avg Square of Diff. Pres., Squared	in H ₂ O	0.700	0.696	0.703	0.700
Dry Gas Molecular Weight	lb/lb-mole	29.93	29.87	29.89	29.90
Wet Stack Gas Molecular Weight	lb/lb-mole	28.08	28.36	28.25	28.23
Average Stack Gas Velocity	ft/sec	61.24	60.71	61.34	61.10
Percent of Isokinetic Rate	% ISO	96.4	93.9	95.2	95.1

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	87,297	86,546	87,444	87,096
Dry Standard Stack Flow/Minute	DSCFM	44,647	45,781	45,369	45,266
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	34,368	33,266	33,945	33,860

Concentration and Emission Rate Data Summary

Mercury (Hg)	ug	386.723	< 43.106	< 72.930	< 167.586
Concentration, ug/DSCM	ug/DSCM	207	< 24.1	< 38.9	< 90.0
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	261	< 32.1	< 50.7	< 115
Concentration, ug/DSCM @ 7% O ₂	ug@7%	269	< 33.2	< 52.0	< 118
Concentration MilliGr/DSCF	mGr/DSCF	9.04E-02	< 1.05E-02	< 1.70E-02	< 3.93E-02
Concentration MilliGr/DSCF @ 12% CO ₂	mGr@12%	1.14E-01	< 1.40E-02	< 2.22E-02	< 5.01E-02
Concentration MilliGr/DSCF @ 7% O ₂	mGr@7%	1.17E-01	< 1.45E-02	< 2.27E-02	< 5.16E-02
Emission Rate, lb/hr	lb/hr	3.46E-02	< 4.13E-03	< 6.61E-03	< 1.51E-02

APPENDIX A.3
Test Results

Unit 1 FF Outlet
Ammonia, Hydrogen Chloride, and Hydrogen Fluoride

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M26A

Client Name	Covanta Energy Group, Inc.			Operator	GLW
Plant Name	Huntington Resource Recovery Facility			Project #	13022
Sampling Location	Unit 1 FF Outlet			Standard Temperature, °F	68
USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1		
Run Number		1-O-M26A-1	1-O-M26A-2	1-O-M26A-3	
Run Date		09/04/13	09/04/13	09/04/13	
Run Start Time	hh:mm	907	1140	1419	
Run Stop Time	hh:mm	1019	1255	1532	
Sampling Parameters					
Meter Calibration Factor	Y	0.9955	0.9955	0.9955	
Y _{QA} Calculated by Test Run	Y _{QA}	0.9925	1.0067	0.9970	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-15.30	-15.70	-15.00	-15.33
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.9	29.9	29.9	29.9
Actual Nozzle Diameter	in	0.210	0.210	0.210	
Carbon Dioxide Percentage	% CO ₂	8.4	7.8	8.0	8.1
Oxygen Percentage	% O ₂	11.3	12.0	11.7	11.7
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.3	80.2	80.3	80.3
Total Water Volume Collected	ml	142.5	124.5	125.5	130.8
Sample Volume	ft ³	36.478	35.505	35.535	35.839
Average Meter Temperature	°F	80	79	82	80
Average Stack Temperature	°F	290	291	290	290
Average Delta H	in H ₂ O	1.13	1.10	1.07	1.10
Total Sampling Time	min	60	60	60	60
Air Flow Parameters					
Volume of Water vapor @ STP	SCF	6.707	5.860	5.907	6.158
Volume Metered @ STP	DSCF	35.591	34.691	34.517	34.933
Absolute Stack/Duct Pressure	in Hg	28.8	28.7	28.8	28.8
Absolute Meter Pressure	in Hg	30.0	30.0	30.0	30.0
Calculated Stack Moisture	% H ₂ O	15.9	14.5	14.6	15.0
Saturated Stack Moisture	% H ₂ O	100.0	100.0	100.0	100.0
Reported Stack Moisture Content	% H ₂ O	15.9	14.5	14.6	15.0
Dry Mole Fraction	decimal	0.841	0.855	0.854	0.850
Avg Square of Differential Pressure	in H ₂ O	1.070	1.056	1.043	1.056
Avg Square of Diff. Pres., Squared	in H ₂ O	1.144	1.114	1.087	1.115
Dry Gas Molecular Weight	lb/lb-mole	29.80	29.73	29.75	29.76
Wet Stack Gas Molecular Weight	lb/lb-mole	27.93	28.03	28.03	28.00
Average Stack Gas Velocity	ft/sec	74.19	73.17	72.18	73.18
Percent of Isokinetic Rate	% ISO	97.3	94.8	95.5	95.8
Air Flow Rate Results					
Actual Stack Flow/Minute	ACFM	96,369	95,037	93,758	95,055
Dry Standard Stack Flow/Minute	DSCFM	54,916	54,936	54,242	54,698
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	37,928	35,175	35,901	36,334

Concentration and Emission Rate Data Summary					
Ammonia	mg	4.45	4.65	7.69	
Molecular Weight	MW	17.01	17.01	17.01	17.01
Concentration, ppm	ppm	6.24	6.69	11.1	8.02
Concentration, ppm @ 12% CO ₂	ppm@12%	8.92	10.3	16.7	12.0
Concentration, ppm @ 7% O ₂	ppm@7%	9.04	10.5	16.8	12.1
Emission Rate, lb/hr	lb/hr	0.908	0.974	1.60	1.16
Hydrogen Chloride	mg	0.892	1.12	1.17	
Molecular Weight	MW	36.46	36.46	36.46	36.46
Concentration, ppm	ppm	0.584	0.752	0.790	0.709
Concentration, ppm @ 12% CO ₂	ppm@12%	0.834	1.16	1.18	1.06
Concentration, ppm @ 7% O ₂	ppm@7%	0.845	1.17	1.19	1.07
Emission Rate, lb/hr	lb/hr	0.182	0.235	0.243	0.220
Hydrogen Fluoride	mg	< 0.045	< 0.042	< 0.043	
Molecular Weight	MW	20.01	20.01	20.01	20.01
Concentration, ppm	ppm	< 0.0537	< 0.0514	< 0.0529	< 0.0527
Concentration, ppm @ 12% CO ₂	ppm@12%	< 0.0767	< 0.0791	< 0.0793	< 0.0784
Concentration, ppm @ 7% O ₂	ppm@7%	< 0.0777	< 0.0803	< 0.0799	< 0.0793
Emission Rate, lb/hr	lb/hr	< 0.00918	< 0.00880	< 0.00894	< 0.00897

Removal Efficiency Summary For:

HCl

Unit #	Repetition Number	ppm @ 7 % O ₂		Removal Efficiency, %
		Inlet Result	Outlet Result	
1	1	571	0.845	99.9%
	2	652	1.17	99.8%
	3	624	1.19	99.8%
AVERAGE =>				99.8%

APPENDIX A.4
Test Results

Unit 1 FF Outlet
Formaldehyde

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M316

Client Name	Covanta Energy Group, Inc.	Operator	EMK
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 1 FF Outlet	Standard Temperature, °F	68
USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1
Run Number	1-O-M316-1	1-O-M316-2	1-O-M316-3
Run Date	08/27/13	08/27/13	08/27/13
Run Start Time	hh:mm	904	1220
Run Stop Time	hh:mm	1015	1329

Sampling Parameters

Meter Calibration Factor	Y	0.9839	0.9955	0.9955	
Y _{QA} Calculated by Test Run	Y _{QA}	0.9676	1.0075	0.9990	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-16.00	-16.00	-16.00	-16.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.7	29.7	29.7	29.7
Actual Nozzle Diameter	in	0.211	0.211	0.211	
Carbon Dioxide Percentage	% CO ₂	8.3	8.8	8.2	8.4
Oxygen Percentage	% O ₂	11.5	10.9	11.5	11.3
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.3	80.3	80.3
Total Water Volume Collected	mL	162.3	186.8	184.3	177.8
Sample Volume	ft ³	36.210	36.835	35.050	36.032
Average Meter Temperature	°F	70	82	86	79
Average Stack Temperature	°F	284	289	290	287
Average Delta H	in H ₂ O	1.08	1.17	1.03	1.09
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	7.639	8.793	8.675	8.369
Volume Metered @ STP	DSCF	35.286	35.521	33.590	34.799
Absolute Stack/Duct Pressure	in Hg	28.5	28.5	28.5	28.5
Absolute Meter Pressure	in Hg	29.8	29.8	29.8	29.8
Calculated Stack Moisture	% H ₂ O	17.8	19.8	20.5	19.4
Dry Mole Fraction	decimal	0.822	0.802	0.795	0.806
Avg Square of Differential Pressure	in H ₂ O	1.032	1.082	1.016	1.043
Avg Square of Diff. Pres., Squared	in H ₂ O	1.065	1.170	1.032	1.089
Dry Gas Molecular Weight	lb/lb-mole	29.79	29.84	29.77	29.80
Wet Stack Gas Molecular Weight	lb/lb-mole	27.69	27.49	27.36	27.51
Average Stack Gas Velocity	ft/sec	71.91	75.91	71.52	73.11
Percent of Isokinetic Rate	% ISO	100.9	99.4	100.8	100.4

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	93,399	98,595	92,892	94,962
Dry Standard Stack Flow/Minute	DSCFM	51,967	53,127	49,556	51,550
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	35,143	38,221	33,513	35,626

Concentration and Emission Rate Data Summary

Formaldehyde	ug	< 15.8	< 10.0	< 9.84	
Molecular Weight	MW	30.03	30.03	30.03	30.03
Concentration, ug/DSCM	ug/DSCM	< 15.8	< 9.9	< 10.3	< 12.0
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 22.9	< 13.6	< 15.1	< 17.2
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 23.4	< 13.8	< 15.3	< 17.5
Emission Rate, lb/hr	lb/hr	< 0.00308	< 0.00198	< 0.00192	< 0.00233

APPENDIX A.5
Test Results

Unit 1 FF Outlet
Particulate and Metals

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M29

Client Name	Covanta Energy Group, Inc.	Operator	13022
Plant Name	Huntington Resource Recovery Facility	Project #	EMK
Sampling Location	Unit 1 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number	1-O-M29-1	1-O-M29-2	1-O-M29-3	
Run Date	09/04/13	09/04/13	09/04/13	
Run Start Time	hh:mm	836	1109	
Run Stop Time	hh:mm	1048	1324	1601

Sampling Parameters

Meter Calibration Factor	Y	0.9839	0.9839	0.9839	
Y _{QA} Calculated by Test Run	Y _{QA}	0.9733	0.9765	0.9734	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-15.00	-15.00	-15.00	-15.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.9	29.9	29.9	29.9
Actual Nozzle Diameter	in	0.212	0.211	0.212	
Carbon Dioxide Percentage	% CO ₂	8.4	7.8	8.0	8.1
Oxygen Percentage	% O ₂	11.3	12.0	11.7	11.7
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.3	80.2	80.3	80.3
Total Water Volume Collected	mL	307.0	249.0	270.5	275.5
Sample Volume	ft ³	76.340	75.315	75.335	75.663
Average Meter Temperature	°F	82	82	79	81
Average Stack Temperature	°F	291	290	289	290
Average Delta H	in H ₂ O	1.19	1.17	1.16	1.17
Total Sampling Time	min	120	120	120	120

Air Flow Parameters

Volume of Water vapor @ STP	SCF	14,450	11,720	12,732	12,968
Volume Metered @ STP	DSCF	73,295	72,374	72,725	72,798
Absolute Stack/Duct Pressure	in Hg	28.8	28.8	28.8	28.8
Absolute Meter Pressure	in Hg	30.0	30.0	30.0	30.0
Calculated Stack Moisture	% H ₂ O	16.5	13.9	14.9	15.1
Dry Mole Fraction	decimal	0.835	0.861	0.851	0.849
Avg Square of Differential Pressure	in H ₂ O	1.077	1.072	1.062	1.070
Avg Square of Diff. Pres., Squared	in H ₂ O	1.161	1.148	1.127	1.145
Dry Gas Molecular Weight	lb/lb-mole	29.80	29.73	29.75	29.76
Wet Stack Gas Molecular Weight	lb/lb-mole	27.85	28.09	28.00	27.98
Average Stack Gas Velocity	ft/sec	74.86	74.10	73.49	74.15
Percent of Isokinetic Rate	% ISO	98.2	95.8	97.2	97.1

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	97,233	96,244	95,455	96,311
Dry Standard Stack Flow/Minute	DSCFM	54,966	56,124	55,112	55,401
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	37,962	35,936	36,477	36,792

Concentration and Emission Rate Data Summary						
Filterable Particulate	mg	2.1	0.6	2.3		1.7
Concentration, gr/DSCF	gr/DSCF	4.42E-04	1.28E-04	4.88E-04		3.53E-04
Concentration, Gr/DSCF @ 12% CO ₂	Gr@12%	6.32E-04	1.97E-04	7.32E-04		5.20E-04
Concentration, Gr/DSCF @ 7% O ₂	Gr@7%	6.40E-04	2.00E-04	7.37E-04		5.26E-04
Concentration, mg/DSCM	mg/DSCM	1.01	0.293	1.12		0.807
Concentration, mg/DSCM @ 7% O ₂	mg@7%	1.46	0.457	1.69		1.20
Emission Rate, lb/hr	lb/hr	0.208	0.062	0.231		0.167
Arsenic (As)	ug	0.322	0.245	0.286		0.284
Concentration, ug/DSCM	ug/DSCM	0.155	0.120	0.139		0.138
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	0.222	0.184	0.208		0.205
Concentration, ug/DSCM @ 7% O ₂	ug@7%	0.225	0.187	0.210		0.207
Emission Rate, lb/hr	lb/hr	3.19E-05	2.51E-05	2.87E-05		2.86E-05
Beryllium (Be)	ug	< 0.050	< 0.050	< 0.050		< 0.050
Concentration, ug/DSCM	ug/DSCM	< 0.0241	< 0.0244	< 0.0243		< 0.0243
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 0.0344	< 0.0375	< 0.0364		< 0.0361
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 0.0349	< 0.0381	< 0.0367		< 0.0366
Emission Rate, lb/hr	lb/hr	< 4.96E-06	< 5.13E-06	< 5.01E-06		< 5.03E-06
Cadmium (Cd)	ug	2.140	0.356	0.559		1.018
Concentration, ug/DSCM	ug/DSCM	1.03	0.173	0.271		0.492
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	1.47	0.267	0.407		0.716
Concentration, ug/DSCM @ 7% O ₂	ug@7%	1.49	0.271	0.410		0.725
Emission Rate, lb/hr	lb/hr	2.12E-04	3.65E-05	5.60E-05		1.02E-04
Total Chromium (Cr)	ug	4.740	3.185	4.930		4.285
Concentration, ug/DSCM	ug/DSCM	2.28	1.55	2.39		2.08
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	3.26	2.39	3.59		3.08
Concentration, ug/DSCM @ 7% O ₂	ug@7%	3.31	2.43	3.62		3.12
Emission Rate, lb/hr	lb/hr	4.70E-04	3.27E-04	4.94E-04		4.30E-04
Lead (Pb)	ug	22.200	5.875	9.180		12.418
Concentration, ug/DSCM	ug/DSCM	10.7	2.87	4.46		6.01
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	15.3	4.41	6.69		8.79
Concentration, ug/DSCM @ 7% O ₂	ug@7%	15.5	4.48	6.73		8.90
Emission Rate, lb/hr	lb/hr	2.20E-03	6.03E-04	9.20E-04		1.24E-03
Manganese (Mn)	ug	7.810	5.020	5.420		6.083
Concentration, ug/DSCM	ug/DSCM	3.76	2.45	2.63		2.95
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	5.38	3.77	3.95		4.36
Concentration, ug/DSCM @ 7% O ₂	ug@7%	5.45	3.83	3.98		4.42
Emission Rate, lb/hr	lb/hr	7.75E-04	5.15E-04	5.43E-04		6.11E-04
Mercury (Hg)	ug	< 1.905	< 1.800	< 1.800		< 1.835
Concentration, ug/DSCM	ug/DSCM	< 0.92	< 0.88	< 0.87		< 0.89
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 1.31	< 1.35	< 1.31		< 1.32
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 1.33	< 1.37	< 1.32		< 1.34
Emission Rate, lb/hr	lb/hr	< 1.89E-04	< 1.85E-04	< 1.80E-04		< 1.85E-04

Nickel (Ni)	ug	7.650	4.110	5.810		5.857
Concentration, ug/DSCM	ug/DSCM	3.69	2.01	2.82		2.84
Concentration, ug/DSCM @ 12% CO2	ug@12%	5.26	3.08	4.23		4.19
Concentration, ug/DSCM @ 7% O2	ug@7%	5.34	3.13	4.26		4.24
Emission Rate, lb/hr	lb/hr	7.59E-04	4.22E-04	5.82E-04		5.88E-04

Vanadium (V)	ug	< 0.200	< 0.200	< 0.200		< 0.200
Concentration, ug/DSCM	ug/DSCM	< 0.096	< 0.098	< 0.097		< 0.097
Concentration, ug/DSCM @ 12% CO2	ug@12%	< 0.138	< 0.150	< 0.146		< 0.144
Concentration, ug/DSCM @ 7% O2	ug@7%	< 0.140	< 0.152	< 0.147		< 0.146
Emission Rate, lb/hr	lb/hr	< 1.98E-05	< 2.05E-05	< 2.00E-05		< 2.01E-05

Zinc (Zn)	ug	90.300	46.700	44.200		60.400
Concentration, ug/DSCM	ug/DSCM	43.5	22.8	21.5		29.2
Concentration, ug/DSCM @ 12% CO2	ug@12%	62.1	35.1	32.2		43.1
Concentration, ug/DSCM @ 7% O2	ug@7%	63.0	35.6	32.4		43.7
Emission Rate, lb/hr	lb/hr	8.96E-03	4.79E-03	4.43E-03		6.06E-03

Removal Efficiency Summary For: Mercury

Unit #	Repetition Number	ug/DSCM @ 7% O2		Removal Efficiency, %
		Inlet Result	Stack Result	
1	1	269	1.33	99.5%
	2	33.2	1.37	95.9%
	3	52.0	1.32	97.5%
AVERAGE =>				97.6%

APPENDIX A.6
Test Results

Unit 1 FF Outlet
PM10

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD:

M201A

Client Name	Covanta Energy Group, Inc.	Operator	WES
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 1 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number	1-O-M201A-1	1-O-M201A-2	1-O-M201A-3	
Run Date	08/29/13	08/30/13	08/30/13	
Run Start Time	hh:mm	1506	753	
Run Stop Time	hh:mm	1706	957	1218

Sampling Parameters

Meter Calibration Factor	Y	0.9955	0.9955	0.9839	
Y _{QA} Calculated by Test Run	Y _{QA}	1.0038	1.0242	0.9382	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.7382	0.7617	0.7382	
Stack/Duct Static Pressure	in H ₂ O	-11.00	-12.00	-12.00	-11.67
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.9	29.9	29.9	29.9
Actual Nozzle Diameter	in	0.181	0.180	0.181	
Carbon Dioxide Percentage	% CO ₂	8.4	8.4	8.5	8.4
Oxygen Percentage	% O ₂	11.4	11.4	11.3	11.4
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.2	80.2
Total Water Volume Collected	mL	155.4	156.4	141.8	151.2
Sample Volume	ft ³	39.416	39.268	41.405	40.030
Average Meter Temperature	°F	79	75	78	78
Average Stack Temperature	°F	281	285	280	282
Average Delta H	in H ₂ O	0.35	0.36	0.37	0.36
Total Sampling Time	min	116.75	117.50	112.50	115.58

Air Flow Parameters

Volume of Water vapor @ STP	SCF	7.315	7.362	6.675	7.117
Volume Metered @ STP	DSCF	38.424	38.597	39.966	38.996
Absolute Stack/Duct Pressure	in Hg	29.1	29.0	29.0	29.0
Absolute Meter Pressure	in Hg	29.9	29.9	29.9	29.9
Calculated Stack Moisture	% H ₂ O	16.0	16.0	14.3	15.4
Reported Stack Moisture Content	% H ₂ O	16.0	16.0	14.3	15.4
Dry Mole Fraction	decimal	0.840	0.840	0.857	0.846
Avg Square of Differential Pressure	in H ₂ O	0.959	0.949	0.918	0.942
Avg Square of Diff. Pres., Squared	in H ₂ O	0.919	0.900	0.843	0.887
Dry Gas Molecular Weight	lb/lb-mole	29.80	29.80	29.81	29.80
Wet Stack Gas Molecular Weight	lb/lb-mole	27.91	27.91	28.12	27.98
Average Stack Gas Velocity	ft/sec	57.79	59.23	55.20	57.41
Percent of Isokinetic Rate	% ISO	91.3	90.6	101.3	94.4

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	75,066	76,930	71,701	74,566
Dry Standard Stack Flow/Minute	DSCFM	43,685	44,433	42,497	43,538
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	29,856	30,368	29,351	29,858

Cyclone Calculations

Sample Flow Rate at Standard Conds.	Q _{sST}	0.329	0.328	0.355	0.338
Cyclone Flow at Actual Conditons	Q _s	0.566	0.569	0.599	0.578
Flue Gas Viscosity, micropoise	μ	215.5	216.3	216.8	216.2
Reynolds Number	Nre	2485	2471	2633	2530
PM 10 Particle Cut Size	D ₅₀	10.37	10.37	9.98	10.24
Cunningham Correction Factor	C	1.087	1.088	1.088	1.088

QA/QC Calculations

%ISO Results, 80% < I < 120%	ISO %	YES	YES	YES	YES
PM10 Cut Size, 9um < D ₅₀ < 11um	PM10	YES	YES	YES	YES
% of Catch <10um	%	48.0	60.0	100.0	69.3

Concentration and Emission Rate Data Summary						
Particulate Fraction <10 microns	mg	1.2	0.6	0.4		0.7
Concentration, Gr/DSCF	gr/DSCF	4.82E-04	2.40E-04	1.54E-04		2.92E-04
Concentration, Gr/DSCF @ 12% CO ₂	Gr@12%	6.89E-04	3.43E-04	2.18E-04		4.16E-04
Concentration, Gr/DSCF @ 7% O ₂	Gr@7%	7.05E-04	3.51E-04	2.24E-04		4.27E-04
Concentration, mg/DSCM	mg/DSCM	1.10	0.549	0.353		0.668
Concentration, mg/DSCM @ 7% O ₂	mg@7%	1.61	0.803	0.512		0.976
Emission Rate, lb/hr	lb/hr	0.180	0.091	0.056		0.109

APPENDIX A.7
Test Results

Unit 1 FF Outlet
Sulfuric Acid Mist

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M8

Client Name	Covanta Energy Group, Inc.	Operator	EMK
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 1 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number	1-O-M8-1	1-O-M8-2	1-O-M8-3	
Run Date	08/27/13	08/27/13	08/27/13	
Run Start Time	hh:mm	1048	1348	
Run Stop Time	hh:mm	1156	1454	

Sampling Parameters

Meter Calibration Factor	Y	0.9955	0.9839	0.9839	
Y_{OA} Calculated by Test Run	Y _{OA}	0.9655	0.9524	0.9496	
Y_{OA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-16.00	-16.00	-16.00	-16.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.7	29.7	29.7	29.7
Actual Nozzle Diameter	in	0.211	0.211	0.211	
Carbon Dioxide Percentage	% CO ₂	8.1	8.6	9.0	8.6
Oxygen Percentage	% O ₂	11.6	11.2	10.8	11.2
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.3	80.2	80.2	80.2
Total Water Volume Collected	mL	184.0	183.9	191.2	186.4
Sample Volume	ft ³	37.825	38.620	38.770	38.405
Average Meter Temperature	°F	76	84	85	82
Average Stack Temperature	°F	287	288	289	288
Average Delta H	in H ₂ O	1.14	1.16	1.17	1.15
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	8.661	8.656	9.000	8.772
Volume Metered @ STP	DSCF	36.896	36.669	36.785	36.783
Absolute Stack/Duct Pressure	in Hg	28.5	28.5	28.5	28.5
Absolute Meter Pressure	in Hg	29.8	29.8	29.8	29.8
Calculated Stack Moisture	% H ₂ O	19.0	19.1	19.7	19.3
Dry Mole Fraction	decimal	0.810	0.809	0.803	0.807
Avg Square of Differential Pressure	in H ₂ O	1.069	1.070	1.070	1.070
Avg Square of Diff. Pres., Squared	in H ₂ O	1.143	1.145	1.145	1.144
Dry Gas Molecular Weight	lb/lb-mole	29.76	29.82	29.87	29.82
Wet Stack Gas Molecular Weight	lb/lb-mole	27.52	27.57	27.54	27.54
Average Stack Gas Velocity	ft/sec	74.88	74.92	75.05	74.95
Percent of Isokinetic Rate	% ISO	103.3	102.8	103.9	103.4

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	97,261	97,310	97,482	97,351
Dry Standard Stack Flow/Minute	DSCFM	53,090	53,007	52,623	52,907
Dry Standard Flow/Minute @ 7% O₂	DSCFM7	35,521	36,991	38,237	36,916

Concentration and Emission Rate Data Summary						
Sulfuric Acid Mist (Ion Chromatography)	mg	< 0.040	< 0.033	< 0.036		
Molecular Weight	MW	98.08	98.08	98.08	98.08	
Concentration, ppm	ppm	< 0.0094	< 0.0078	< 0.0085		< 0.0086
Concentration, ppm @ 12% CO ₂	ppm@12%	< 0.0139	< 0.0109	< 0.0113		< 0.0120
Concentration, ppm @ 7% O ₂	ppm@7%	< 0.0140	< 0.0112	< 0.0117		< 0.0123
Emission Rate, lb/hr	lb/hr	< 0.00761	< 0.00631	< 0.00681		< 0.00691

APPENDIX A.8
Test Results

Unit 1 FF Outlet
Total Hydrocarbons as Ethane

CONCENTRATION AND EMISSION RATE DATA SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery Facility
Sampling Location	Unit 1 FF Outlet
Operator	13022
Project #	PJJ

Repetition Number	1	2	3	SET AVERAGE
Run Date	08/27/13	08/27/13	08/27/13	
Run Start Time	hh:mm	904	1104	
Run Stop Time	hh:mm	1050	1245	

Unit 1 FF Outlet	% H ₂ O	18.2	19.3	19.3	18.9
Moisture Content	Mfd	0.818	0.807	0.807	0.811
Dry Mole Fraction	% O ₂	11.541	11.687	11.191	11.473
Oxygen Percentage	% CO ₂	8.596	8.550	8.807	8.651
Carbon Dioxide Percentage	DSCFM	52,341	53,102	53,047	52,830

Unit 1 FF Outlet	Fwt	30.06	30.06	30.06	
Total Hydrocarbons (as Ethane)	ppmw	0.177	0.307	0.177	0.219
Concentration, ppm (wet)	ppmvd	0.217	0.380	0.213	0.270
Concentration, ppm (dry)	ppm@7%O ₂	0.322	0.561	0.307	0.397
Concentration, ppm@12%CO ₂	ppm@12%CO ₂	0.303	0.527	0.291	0.374
Emission Rate, lb/hr	lb/hr	0.053	0.095	0.053	0.067

CONCENTRATION AND EMISSION RATE SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery
Sampling Location	Unit 1 FF Outlet
Operator	13022
Project #	PJJ

USE IN AVERAGE OF RUN SET? 1 or 0 =>		1	1	1	
CEM Run Number		1	2	3	
Run Date		08/27/13	08/27/13	08/27/13	
Run Start Time	hh:mm	904	946	1026	SET
Run Stop Time	hh:mm	928	1010	1050	AVERAGE

Unit 1 FF Outlet		% H ₂ O	17.8	17.8	19.0	18.2
Moisture Content	% H ₂ O	Mfd	0.822	0.822	0.810	0.818
Dry Mole Fraction	Mfd	% O ₂	11.454	11.639	11.331	11.541
Oxygen Percentage	Mfd	% CO ₂	8.656	8.429	8.704	8.596
Carbon Dioxide Percentage	Mfd	DSCFM	51,967	51,967	53,090	52,341
Air Flow and Moisture Taken From Test Run =>		1-O-M316-1	1-O-M316-1	1-O-M8-1		

Unit 1 FF Outlet		Fwt	30.06	30.06	30.06	
Total Hydrocarbons (as Ethane)		ppmw	0.201	0.193	0.138	0.177
Formula Weight of Ethane		ppmvd	0.245	0.235	0.170	0.217
Concentration, ppm (wet)		ppm@7%O ₂	0.360	0.360	0.247	0.322
Concentration, ppm (dry)		ppm@12%CO ₂	0.339	0.334	0.235	0.303
Concentration, ppm@7%O₂		lb/hr	0.059	0.057	0.042	0.053
Emission Rate, lb/hr						

CONCENTRATION AND EMISSION RATE SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery
Sampling Location	Unit 1 FF Outlet
Operator	13022
Project #	PJJ

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	
CEM Run Number	4	5	6	
Run Date		08/27/13	08/27/13	08/27/13
Run Start Time	hh:mm	1104	1143	1221
Run Stop Time	hh:mm	1128	1207	1245
				SET AVERAGE

Unit 1 FF Outlet	% H ₂ O	19.0	19.0	19.8	19.3
Moisture Content	% H ₂ O	19.0	19.0	19.8	19.3
Dry Mole Fraction	Mfd	0.810	0.810	0.802	0.807
Oxygen Percentage	% O ₂	12.372	10.886	11.803	11.687
Carbon Dioxide Percentage	% CO ₂	8.217	8.901	8.532	8.550
Dry Standard Stack Flow Rate	DSCFM	53,090	53,090	53,127	53,102
Air Flow and Moisture Taken From Test Run =>		1-O-M8-1	1-O-M8-1	1-O-316-2	

Unit 1 FF Outlet	Fwt	30.06	30.06	30.06	
Total Hydrocarbons (as Ethane)	ppmw	0.212	0.503	0.207	0.307
Concentration, ppm (wet)	ppmvw	0.212	0.503	0.207	0.307
Concentration, ppm (dry)	ppmvd	0.262	0.621	0.258	0.380
Concentration, ppm@7%O₂	ppm@7%O ₂	0.427	0.862	0.394	0.561
Concentration, ppm@12%CO₂	ppm@12%CO ₂	0.382	0.837	0.363	0.527
Emission Rate, lb/hr	lb/hr	0.065	0.154	0.064	0.095

CONCENTRATION AND EMISSION RATE SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery
Sampling Location	Unit 1 FF Outlet
Operator	13022
Project #	PJJ

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	
CEM Run Number	7	8	9	
Run Date		08/27/13	08/27/13	08/27/13
Run Start Time	hh:mm	1302	1348	1427
Run Stop Time	hh:mm	1326	1412	1451
				SET AVERAGE

Unit 1 FF Outlet					
Moisture Content	% H ₂ O	19.8	19.1	19.1	19.3
Dry Mole Fraction	Mfd	0.802	0.809	0.809	0.807
Oxygen Percentage	% O ₂	11.671	10.944	10.958	11.191
Carbon Dioxide Percentage	% CO ₂	8.619	8.926	8.875	8.807
Dry Standard Stack Flow Rate	DSCFM	53,127	53,007	53,007	53,047
Air Flow and Moisture Taken From Test Run =>		1-O-316-2	1-O-M8-2	1-O-M8-2	

Unit 1 FF Outlet					
Total Hydrocarbons (as Ethane)					
Formula Weight of Ethane	Fwt	30.06	30.06	30.06	
Concentration, ppm (wet)	ppmw	0.214	0.211	0.090	0.172
Concentration, ppm (dry)	ppmvd	0.267	0.261	0.111	0.213
Concentration, ppm@7%O ₂	ppm@7%O ₂	0.402	0.364	0.156	0.307
Concentration, ppm@12%CO ₂	ppm@12%CO ₂	0.372	0.351	0.150	0.291
Emission Rate, lb/hr	lb/hr	0.066	0.065	0.028	0.053

APPENDIX A.9
Test Results

Unit 2 SDA Inlet
Hydrogen Chloride

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

MM26

Client Name	Covanta Energy Group, Inc.	Operator	CAN
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 2 SDA Inlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1		SET AVERAGE
Run Number		2-I-MM26-1	2-I-MM26-2	2-I-MM26-3	
Run Date		09/06/13	09/06/13	09/06/13	
Run Start Time	hh:mm	848	1127	1358	
Run Stop Time	hh:mm	1000	1238	1507	

Sampling Parameters

Meter Calibration Factor	Y	1.0052	1.0052	1.0052	
Y_{QA} Calculated by Test Run	Y _{QA}	1.0157	1.0028	1.0025	
Y_{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C ₀	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-2.50	-2.50	-2.50	-2.50
Barometric Pressure	in Hg	30.1	30.1	30.1	30.1
Carbon Dioxide Percentage	% CO ₂	9.5	10.0	9.9	9.8
Oxygen Percentage	% O ₂	10.3	9.8	9.8	10.0
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.3	80.2
Total Water Volume Collected	mL	150.5	119.5	123.5	131.2
Sample Volume	ft ³	38.975	39.290	39.448	39.238
Average Meter Temperature	°F	75	71	74	73
Average Delta H	in H ₂ O	1.20	1.20	1.20	1.20
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	7.084	5.625	5.813	6.174
Volume Metered @ STP	DSCF	39.017	39.632	39.512	39.387
Absolute Stack/Duct Pressure	in Hg	29.9	29.9	29.9	29.9
Absolute Meter Pressure	in Hg	30.2	30.2	30.2	30.2
Calculated Stack Moisture	% H ₂ O	15.4	12.4	12.8	13.5

Concentration and Emission Rate Data Summary

Hydrogen Chloride	mg	771	1465	993	
Molecular Weight	MW	36.46	36.46	36.46	36.46
Concentration, ppm	ppm	460	861	586	636
Concentration, ppm @ 12% CO₂	ppm@12%	582	1033	710	775
Concentration, ppm @ 7% O₂	ppm@7%	604	1078	733	805

APPENDIX A.10
Test Results

Unit 2 SDA Inlet
Mercury

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M29

Client Name	Covanta Energy Group, Inc.	Operator	CAN
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 2 SDA Inlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number		2-I-M29-1	2-I-M29-2	
Run Date		09/06/13	09/06/13	
Run Start Time	hh:mm	817	1050	
Run Stop Time	hh:mm	1029	1307	

Sampling Parameters

Meter Calibration Factor	Y	0.9919	0.9919	0.9919	
Y _{QA} Calculated by Test Run	Y _{QA}	0.9776	0.9808	0.9809	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-2.50	-2.50	-2.50	-2.50
Stack Cross-Sectional Area	ft ²	23.758	23.758	23.758	23.758
Barometric Pressure	in Hg	30.1	30.1	30.1	30.1
Actual Nozzle Diameter	in	0.236	0.231	0.236	
Carbon Dioxide Percentage	% CO ₂	9.5	10.0	9.9	9.8
Oxygen Percentage	% O ₂	10.3	9.8	9.8	10.0
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.3	80.2
Total Water Volume Collected	mL	252.5	209.5	224.4	228.8
Sample Volume	ft ³	65.415	66.675	69.387	67.159
Average Meter Temperature	°F	78	79	82	80
Average Stack Temperature	°F	416	427	426	423
Average Delta H	in H ₂ O	0.86	0.90	0.97	0.91
Total Sampling Time	min	120	120	120	120

Air Flow Parameters

Volume of Water vapor @ STP	SCF	11.885	9.861	10.563	10.770
Volume Metered @ STP	DSCF	64.133	65.274	67.570	65.659
Absolute Stack/Duct Pressure	in Hg	29.9	29.9	29.9	29.9
Absolute Meter Pressure	in Hg	30.2	30.2	30.2	30.2
Calculated Stack Moisture	% H ₂ O	15.6	13.1	13.5	14.1
Dry Mole Fraction	decimal	0.844	0.869	0.865	0.859
Avg Square of Differential Pressure	in H ₂ O	0.775	0.817	0.812	0.801
Avg Square of Diff. Pres., Squared	in H ₂ O	0.601	0.668	0.659	0.643
Dry Gas Molecular Weight	lb/lb-mole	29.93	29.99	29.98	29.97
Wet Stack Gas Molecular Weight	lb/lb-mole	28.07	28.42	28.36	28.28
Average Stack Gas Velocity	ft/sec	56.88	59.94	59.57	58.80
Percent of Isokinetic Rate	% ISO	101.5	100.5	100.7	100.9

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	81,081	85,446	84,920	83,816
Dry Standard Stack Flow/Minute	DSCFM	41,205	44,199	43,766	43,057
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	31,423	35,295	34,950	33,889

Concentration and Emission Rate Data Summary

Mercury (Hg)	ug	< 67.150	< 63.749	< 209.647	< 113.515
Concentration, ug/DSCM	ug/DSCM	< 37.0	< 34.5	< 110	< 60.3
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 46.7	< 41.4	< 133	< 73.6
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 48.5	< 43.2	< 137	< 76.3
Concentration MilliGr/DSCF	mGr/DSCF	< 1.62E-02	< 1.51E-02	< 4.79E-02	< 2.64E-02
Concentration MilliGr/DSCF @ 12% CO ₂	mGr@12%	< 2.04E-02	< 1.81E-02	< 5.80E-02	< 3.22E-02
Concentration MilliGr/DSCF @ 7% O ₂	mGr@7%	< 2.12E-02	< 1.89E-02	< 6.00E-02	< 3.33E-02
Emission Rate, lb/hr	lb/hr	< 5.71E-03	< 5.71E-03	< 1.80E-02	< 9.79E-03

APPENDIX A.11
Test Results

Unit 2 FF Outlet
Ammonia, Hydrogen Chloride, and Hydrogen Fluoride

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M26A

Client Name	Covanta Energy Group, Inc.	Operator	GLW
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 2 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number	2-O-M26A-1	2-O-M26A-2	2-O-M26A-3	
Run Date	09/06/13	09/06/13	09/06/13	
Run Start Time	hh:mm	848	1127	
Run Stop Time	hh:mm	1000	1238	

Sampling Parameters

Meter Calibration Factor	Y	1.0077	1.0077	1.0077	
Y _{OA} Calculated by Test Run	Y _{OA}	1.0076	0.9852	0.9970	
Y _{OA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-14.50	-14.80	-14.50	-14.60
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	30.1	30.1	30.1	30.1
Actual Nozzle Diameter	in	0.212	0.212	0.212	
Carbon Dioxide Percentage	% CO ₂	8.5	8.6	8.5	8.5
Oxygen Percentage	% O ₂	11.3	11.2	11.2	11.2
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.3	80.2
Total Water Volume Collected	mL	143.4	134.9	142.6	140.3
Sample Volume	ft ³	30.623	33.600	32.965	32.396
Average Meter Temperature	°F	73	71	74	73
Average Stack Temperature	°F	291	291	291	291
Average Delta H	in H ₂ O	0.81	0.93	0.91	0.88
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	6.750	6.350	6.712	6.604
Volume Metered @ STP	DSCF	30.821	33.929	33.108	32.620
Absolute Stack/Duct Pressure	in Hg	29.0	29.0	29.0	29.0
Absolute Meter Pressure	in Hg	30.2	30.2	30.2	30.2
Calculated Stack Moisture	% H ₂ O	18.0	15.8	16.9	16.9
Saturated Stack Moisture	% H ₂ O	100.0	100.0	100.0	100.0
Reported Stack Moisture Content	% H ₂ O	18.0	15.8	16.9	16.9
Dry Mole Fraction	decimal	0.820	0.842	0.831	0.831
Avg Square of Differential Pressure	in H ₂ O	0.902	0.970	0.935	0.936
Avg Square of Diff. Pres., Squared	in H ₂ O	0.814	0.940	0.874	0.876
Dry Gas Molecular Weight	lb/lb-mole	29.81	29.82	29.81	29.81
Wet Stack Gas Molecular Weight	lb/lb-mole	27.69	27.96	27.82	27.82
Average Stack Gas Velocity	ft/sec	62.61	66.98	64.73	64.77
Percent of Isokinetic Rate	% ISO	99.7	100.0	102.2	100.6

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	81,325	86,994	84,079	84,133
Dry Standard Stack Flow/Minute	DSCFM	45,518	49,984	47,712	47,738
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	31,437	34,881	33,295	33,204

Concentration and Emission Rate Data Summary						
Ammonia	mg	1.27	1.36	1.23		
Molecular Weight	MW	17.01	17.01	17.01	17.01	
Concentration, ppm	ppm	2.06	2.00	1.86		1.97
Concentration, ppm @ 12% CO ₂	ppm@12%	2.91	2.79	2.62		2.77
Concentration, ppm @ 7% O ₂	ppm@7%	2.98	2.87	2.66		2.84
Emission Rate, lb/hr	lb/hr	0.248	0.265	0.234		0.249
Hydrogen Chloride	mg	0.973	1.75	1.65		
Molecular Weight	MW	36.46	36.46	36.46	36.46	
Concentration, ppm	ppm	0.74	1.20	1.16		1.03
Concentration, ppm @ 12% CO ₂	ppm@12%	1.04	1.68	1.64		1.45
Concentration, ppm @ 7% O ₂	ppm@7%	1.06	1.72	1.66		1.48
Emission Rate, lb/hr	lb/hr	0.190	0.341	0.315		0.282
Hydrogen Fluoride	mg	< 0.044	< 0.042	< 0.044		
Molecular Weight	MW	20.01	20.01	20.01	20.01	
Concentration, ppm	ppm	< 0.0606	< 0.0525	< 0.0564		< 0.0565
Concentration, ppm @ 12% CO ₂	ppm@12%	< 0.0856	< 0.0733	< 0.0796		< 0.0795
Concentration, ppm @ 7% O ₂	ppm@7%	< 0.0877	< 0.0753	< 0.0808		< 0.0813
Emission Rate, lb/hr	lb/hr	< 0.00860	< 0.00818	< 0.00839		< 0.00839

Removal Efficiency Summary For:

HCl

Unit #	Repetition Number	ppm @ 7 % O2		Removal Efficiency, %
		Inlet Result	Outlet Result	
2	1	604	1.06	99.8%
	2	1078	1.72	99.8%
	3	733	1.66	99.8%
AVERAGE =>				99.8%

APPENDIX A.12
Test Results

Unit 2 FF Outlet
Formaldehyde

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M316

Client Name	Covanta Energy Group, Inc.	Operator	EMK
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 2 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number		2-O-M316-1	2-O-M316-2	
Run Date		08/28/13	08/28/13	
Run Start Time	hh:mm	947	1358	
Run Stop Time	hh:mm	1052	1539	

Sampling Parameters

Meter Calibration Factor	Y	0.9754	0.9754	0.9754	
Y _{QA} Calculated by Test Run	Y _{QA}	0.9505	0.9343	0.9399	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-15.00	-15.00	-15.00	-15.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.7	29.7	29.7	29.7
Actual Nozzle Diameter	in	0.211	0.211	0.211	
Carbon Dioxide Percentage	% CO ₂	9.5	9.2	9.5	9.4
Oxygen Percentage	% O ₂	10.1	10.4	10.1	10.2
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.4	80.4	80.4	80.4
Total Water Volume Collected	mL	173.0	141.6	157.0	157.2
Sample Volume	ft ³	37.855	35.060	35.810	36,242
Average Meter Temperature	°F	90	90	87	89
Average Stack Temperature	°F	278	278	277	278
Average Delta H	in H ₂ O	1.10	0.91	0.97	0.99
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	8.143	6.665	7.390	7.399
Volume Metered @ STP	DSCF	35.250	32.668	33.513	33.810
Absolute Stack/Duct Pressure	in Hg	28.6	28.6	28.6	28.6
Absolute Meter Pressure	in Hg	29.8	29.8	29.8	29.8
Calculated Stack Moisture	% H ₂ O	18.8	16.9	18.1	17.9
Dry Mole Fraction	decimal	0.812	0.831	0.819	0.821
Avg Square of Differential Pressure	in H ₂ O	1.040	0.946	0.974	0.987
Avg Square of Diff. Pres., Squared	in H ₂ O	1.082	0.895	0.949	0.975
Dry Gas Molecular Weight	lb/lb-mole	29.92	29.89	29.92	29.91
Wet Stack Gas Molecular Weight	lb/lb-mole	27.69	27.87	27.77	27.78
Average Stack Gas Velocity	ft/sec	72.14	65.36	67.39	68.29
Percent of Isokinetic Rate	% ISO	100.7	100.7	101.4	101.0

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	93,696	84,890	87,534	88,707
Dry Standard Stack Flow/Minute	DSCFM	52,023	48,212	49,109	49,782
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	40,421	36,419	38,157	38,332

Concentration and Emission Rate Data Summary

Formaldehyde	ug	< 9.24	< 9.77	< 9.24	
Molecular Weight	MW	30.03	30.03	30.03	30.03
Concentration, ug/DSCM	ug/DSCM	< 9.26	< 10.6	< 9.74	< 9.85
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 11.7	< 13.8	< 12.3	< 12.6
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 11.9	< 14.0	< 12.5	< 12.8
Emission Rate, lb/hr	lb/hr	< 0.00180	< 0.00191	< 0.00179	< 0.00183

APPENDIX A.13
Test Results

Unit 2 FF Outlet
Particulate and Metals

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M29

Client Name	Covanta Energy Group, Inc.	Operator	EMK
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 2 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number		2-O-M29-1	2-O-M29-2	
Run Date		09/06/13	09/06/13	
Run Start Time	hh:mm	817	1050	
Run Stop Time	hh:mm	1029	1307	

Sampling Parameters

Meter Calibration Factor	Y	0.9754	0.9754	0.9754	
Y _{OA} Calculated by Test Run	Y _{OA}	0.9438	0.9402	0.9366	
Y _{OA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-14.50	-14.50	-14.50	-14.50
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	30.1	30.1	30.1	30.1
Actual Nozzle Diameter	in	0.210	0.211	0.210	
Carbon Dioxide Percentage	% CO ₂	8.5	8.6	8.5	8.5
Oxygen Percentage	% O ₂	11.3	11.2	11.2	11.2
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.3	80.2
Total Water Volume Collected	mL	287.2	252.8	280.0	273.3
Sample Volume	ft ³	65.715	66.520	71.180	67.805
Average Meter Temperature	°F	73	75	78	75
Average Stack Temperature	°F	275	277	276	276
Average Delta H	in H ₂ O	0.85	0.86	0.98	0.90
Total Sampling Time	min	120	120	120	120

Air Flow Parameters

Volume of Water vapor @ STP	SCF	13.519	11.899	13.180	12.866
Volume Metered @ STP	DSCF	63.934	64.590	68.709	65.744
Absolute Stack/Duct Pressure	in Hg	29.0	29.0	29.0	29.0
Absolute Meter Pressure	in Hg	30.2	30.2	30.2	30.2
Calculated Stack Moisture	% H ₂ O	17.5	15.6	16.1	16.4
Dry Mole Fraction	decimal	0.825	0.844	0.839	0.836
Avg Square of Differential Pressure	in H ₂ O	0.896	0.894	0.960	0.917
Avg Square of Diff. Pres., Squared	in H ₂ O	0.803	0.800	0.921	0.841
Dry Gas Molecular Weight	lb/lb-mole	29.81	29.82	29.81	29.81
Wet Stack Gas Molecular Weight	lb/lb-mole	27.75	27.98	27.91	27.88
Average Stack Gas Velocity	ft/sec	61.43	61.15	65.70	62.76
Percent of Isokinetic Rate	% ISO	104.4	102.9	103.5	103.6

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	79,795	79,423	85,336	81,518
Dry Standard Stack Flow/Minute	DSCFM	45,944	46,641	49,834	47,473
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	31,731	32,548	34,776	33,018

Concentration and Emission Rate Data Summary						
Filterable Particulate	mg	2.1	1.1	0.9		1.4
Concentration, gr/DSCF	gr/DSCF	5.07E-04	2.63E-04	2.02E-04		3.24E-04
Concentration, Gr/DSCF @ 12% CO ₂	Gr@12%	7.16E-04	3.67E-04	2.85E-04		4.56E-04
Concentration, Gr/DSCF @ 7% O ₂	Gr@7%	7.34E-04	3.77E-04	2.90E-04		4.67E-04
Concentration, mg/DSCM	mg/DSCM	1.16	0.601	0.463		0.741
Concentration, mg/DSCM @ 7% O ₂	mg@7%	1.68	0.862	0.663		1.07
Emission Rate, lb/hr	lb/hr	0.200	0.105	0.086		0.130
Arsenic (As)	ug	0.228	0.207	< 0.200	<	0.212
Concentration, ug/DSCM	ug/DSCM	0.126	0.113	< 0.103	<	0.114
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	0.178	0.158	< 0.145	<	0.160
Concentration, ug/DSCM @ 7% O ₂	ug@7%	0.182	0.162	< 0.147	<	0.164
Emission Rate, lb/hr	lb/hr	2.17E-05	1.98E-05	< 1.92E-05	<	2.02E-05
Beryllium (Be)	ug	< 0.050	< 0.050	< 0.050	<	0.050
Concentration, ug/DSCM	ug/DSCM	< 0.0276	< 0.0273	< 0.0257	<	0.0269
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 0.0390	< 0.0381	< 0.0363	<	0.0378
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 0.0400	< 0.0392	< 0.0368	<	0.0387
Emission Rate, lb/hr	lb/hr	< 4.75E-06	< 4.78E-06	< 4.80E-06	<	4.78E-06
Cadmium (Cd)	ug	0.289	0.290	0.281		0.287
Concentration, ug/DSCM	ug/DSCM	0.160	0.158	0.144		0.154
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	0.225	0.221	0.204		0.217
Concentration, ug/DSCM @ 7% O ₂	ug@7%	0.231	0.227	0.207		0.222
Emission Rate, lb/hr	lb/hr	2.75E-05	2.77E-05	2.70E-05		2.74E-05
Total Chromium (Cr)	ug	3.370	3.725	2.990		3.362
Concentration, ug/DSCM	ug/DSCM	1.86	2.04	1.54		1.81
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	2.63	2.84	2.17		2.55
Concentration, ug/DSCM @ 7% O ₂	ug@7%	2.69	2.92	2.20		2.61
Emission Rate, lb/hr	lb/hr	3.20E-04	3.56E-04	2.87E-04		3.21E-04
Lead (Pb)	ug	4.440	3.345	4.090		3.958
Concentration, ug/DSCM	ug/DSCM	2.45	1.83	2.10		2.13
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	3.46	2.55	2.97		2.99
Concentration, ug/DSCM @ 7% O ₂	ug@7%	3.55	2.62	3.01		3.06
Emission Rate, lb/hr	lb/hr	4.22E-04	3.20E-04	3.92E-04		3.78E-04
Manganese (Mn)	ug	3.190	5.375	2.540		3.702
Concentration, ug/DSCM	ug/DSCM	1.76	2.94	1.31		2.00
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	2.49	4.10	1.84		2.81
Concentration, ug/DSCM @ 7% O ₂	ug@7%	2.55	4.21	1.87		2.88
Emission Rate, lb/hr	lb/hr	3.03E-04	5.13E-04	2.44E-04		3.53E-04
Mercury (Hg)	ug	< 4.025	< 1.800	< 1.800	<	2.542
Concentration, ug/DSCM	ug/DSCM	< 2.22	< 0.98	< 0.93	<	1.38
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 3.14	< 1.37	< 1.31	<	1.94
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 3.22	< 1.41	< 1.33	<	1.98
Emission Rate, lb/hr	lb/hr	< 3.83E-04	< 1.72E-04	< 1.73E-04	<	2.42E-04

Nickel (Ni)	ug	6.230	4.825	3.340		4.798
Concentration, ug/DSCM	ug/DSCM	3.44	2.64	1.72		2.60
Concentration, ug/DSCM @ 12% CO2	ug@12%	4.86	3.68	2.42		3.65
Concentration, ug/DSCM @ 7% O2	ug@7%	4.98	3.78	2.46		3.74
Emission Rate, lb/hr	lb/hr	5.92E-04	4.61E-04	3.20E-04		4.58E-04

Vanadium (V)	ug	< 0.200	< 0.200	< 0.200		< 0.200
Concentration, ug/DSCM	ug/DSCM	< 0.110	< 0.109	< 0.103		< 0.108
Concentration, ug/DSCM @ 12% CO2	ug@12%	< 0.156	< 0.153	< 0.145		< 0.151
Concentration, ug/DSCM @ 7% O2	ug@7%	< 0.160	< 0.157	< 0.147		< 0.155
Emission Rate, lb/hr	lb/hr	< 1.90E-05	< 1.91E-05	< 1.92E-05		< 1.91E-05

Zinc (Zn)	ug	39.500	35.750	29.100		34.783
Concentration, ug/DSCM	ug/DSCM	21.8	19.5	15.0		18.8
Concentration, ug/DSCM @ 12% CO2	ug@12%	30.8	27.3	21.1		26.4
Concentration, ug/DSCM @ 7% O2	ug@7%	31.6	28.0	21.4		27.0
Emission Rate, lb/hr	lb/hr	3.75E-03	3.41E-03	2.79E-03		3.32E-03

Removal Efficiency Summary For: Mercury

Unit #	Repitition Number	ug/DSCM @ 7% O2		Removal Efficiency, %
		Inlet Result	Stack Result	
2	1	48.5	3.22	93.4%
	2	43.2	1.41	96.7%
	3	137	1.33	99.0%
AVERAGE =>				96.4%

APPENDIX A.14
Test Results

Unit 2 FF Outlet
PM10

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD:

M201A

Client Name	Covanta Energy Group, Inc.	Operator	WES
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 2 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>		1	1	1	SET AVERAGE
Run Number		2-O-M201A-2	2-O-M201A-3	2-O-M201A-4	
Run Date		08/27/13	08/27/13	08/29/13	
Run Start Time	hh:mm	1240	1544	854	
Run Stop Time	hh:mm	1450	1750	1108	

Sampling Parameters

Meter Calibration Factor	Y	0.9754	0.9754	0.9754	
Y _{QA} Calculated by Test Run	Y _{QA}	0.9337	0.9326	0.9281	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.7617	0.7382	0.7617	
Stack/Duct Static Pressure	in H ₂ O	-15.00	-15.00	-15.00	-15.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.7	29.7	29.7	29.7
Actual Nozzle Diameter	in	0.164	0.164	0.180	
Carbon Dioxide Percentage	% CO ₂	8.9	9.4	9.0	9.1
Oxygen Percentage	% O ₂	10.9	10.3	10.8	10.7
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.3	80.2	80.2
Total Water Volume Collected	mL	188.2	199.2	184.2	190.5
Sample Volume	ft ³	45.660	44.531	46.835	45.675
Average Meter Temperature	°F	86	87	77	83
Average Stack Temperature	°F	277	277	277	277
Average Delta H	in H ₂ O	0.36	0.37	0.37	0.37
Total Sampling Time	min	124.00	119.00	125.75	122.92

Air Flow Parameters

Volume of Water vapor @ STP	SCF	8.859	9.376	8.670	8.968
Volume Metered @ STP	DSCF	42.829	41.663	44.662	43.052
Absolute Stack/Duct Pressure	in Hg	28.6	28.6	28.6	28.6
Absolute Meter Pressure	in Hg	29.7	29.7	29.7	29.7
Calculated Stack Moisture	% H ₂ O	17.1	18.4	16.3	17.3
Reported Stack Moisture Content	% H ₂ O	17.1	18.4	16.3	17.3
Dry Mole Fraction	decimal	0.829	0.816	0.837	0.827
Avg Square of Differential Pressure	in H ₂ O	1.034	1.058	0.980	1.024
Avg Square of Diff. Pres., Squared	in H ₂ O	1.068	1.120	0.961	1.050
Dry Gas Molecular Weight	lb/lb-mole	29.86	29.92	29.87	29.88
Wet Stack Gas Molecular Weight	lb/lb-mole	27.83	27.73	27.94	27.83
Average Stack Gas Velocity	ft/sec	64.79	64.42	61.29	63.50
Percent of Isokinetic Rate	% ISO	106.8	110.5	95.3	104.2

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	84,150	83,672	79,609	82,477
Dry Standard Stack Flow/Minute	DSCFM	47,719	46,742	45,665	46,709
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	34,330	35,645	33,181	34,385

Cyclone Calculations

Sample Flow Rate at Standard Conds.	Q _{ST}	0.345	0.350	0.355	0.350
Cyclone Flow at Actual Conditions	Q _s	0.609	0.627	0.619	0.618
Flue Gas Viscosity, micropoise	μ	213.3	211.9	213.9	213.1
Reynolds Number	N _{re}	2662	2747	2712	2707
PM 10 Particle Cut Size	D ₅₀	9.80	9.56	9.69	9.69
Cunningham Correction Factor	C	1.088	1.087	1.088	1.088

QA/QC Calculations

%ISO Results, 80% < I < 120%	ISO %	YES	YES	YES	YES
PM10 Cut Size, 9um < D ₅₀ < 11um	PM10	YES	YES	YES	YES
% of Catch <10um	%	40.0	50.0	42.9	44.3

Concentration and Emission Rate Data Summary						
Particulate Fraction <10 microns	mg		0.6	1.2	0.6	0.8
Concentration, Gr/DSCF	gr/DSCF		2.16E-04	4.44E-04	2.07E-04	2.89E-04
Concentration, Gr/DSCF @ 12% CO ₂	Gr@12%		2.91E-04	5.67E-04	2.76E-04	3.78E-04
Concentration, Gr/DSCF @ 7% O ₂	Gr@7%		3.01E-04	5.83E-04	2.85E-04	3.90E-04
Concentration, mg/DSCM	mg/DSCM		0.495	1.02	0.474	0.662
Concentration, mg/DSCM @ 7% O ₂	mg@7%		0.688	1.33	0.653	0.891
Emission Rate, lb/hr	lb/hr		0.088	0.178	0.081	0.116

APPENDIX A.15
Test Results

Unit 2 FF Outlet
Sulfuric Acid Mist

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M8

Client Name	Covanta Energy Group, Inc.	Operator	EMK
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 2 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1		SET AVERAGE
Run Number		2-O-M8-1	2-O-M8-2	2-O-M8-3	
Run Date		08/28/13	08/28/13	08/28/13	
Run Start Time	hh:mm	1109	1232	1559	
Run Stop Time	hh:mm	1214	1336	1703	

Sampling Parameters

Meter Calibration Factor	Y	0.9754	0.9754	0.9754	
Y _{QA} Calculated by Test Run	Y _{QA}	0.9503	0.9384	0.9370	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-15.00	-15.00	-15.00	-15.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.7	29.7	29.7	29.7
Actual Nozzle Diameter	in	0.211	0.214	0.214	
Carbon Dioxide Percentage	% CO ₂	9.6	9.1	9.5	9.4
Oxygen Percentage	% O ₂	10.0	10.5	10.1	10.2
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.4	80.4	80.4	80.4
Total Water Volume Collected	mL	162.6	174.7	153.4	163.6
Sample Volume	ft ³	36.010	39.560	36.985	37.518
Average Meter Temperature	°F	92	91	87	90
Average Stack Temperature	°F	278	278	278	278
Average Delta H	in H ₂ O	0.99	1.17	1.02	1.06
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	7.654	8.223	7.221	7.699
Volume Metered @ STP	DSCF	33.394	36.808	34.621	34.941
Absolute Stack/Duct Pressure	in Hg	28.6	28.6	28.6	28.6
Absolute Meter Pressure	in Hg	29.8	29.8	29.8	29.8
Calculated Stack Moisture	% H ₂ O	18.6	18.3	17.3	18.1
Dry Mole Fraction	decimal	0.814	0.817	0.827	0.819
Avg Square of Differential Pressure	in H ₂ O	0.987	1.043	0.977	1.002
Avg Square of Diff. Pres., Squared	in H ₂ O	0.974	1.087	0.954	1.005
Dry Gas Molecular Weight	lb/lb-mole	29.94	29.88	29.92	29.91
Wet Stack Gas Molecular Weight	lb/lb-mole	27.71	27.71	27.87	27.76
Average Stack Gas Velocity	ft/sec	68.42	72.28	67.49	69.40
Percent of Isokinetic Rate	% ISO	100.5	101.4	100.8	100.9

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	88,867	93,879	87,667	90,138
Dry Standard Stack Flow/Minute	DSCFM	49,413	52,458	49,628	50,500
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	38,748	39,249	38,560	38,852

Concentration and Emission Rate Data Summary						
Sulfuric Acid Mist (Ion Chromatography)	mg	< 0.032	< 0.032	< 0.045		
Molecular Weight	MW	98.08	98.08	98.08	98.08	
Concentration, ppm	ppm	< 0.0083	< 0.0075	< 0.0113		< 0.0090
Concentration, ppm @ 12% CO ₂	ppm@12%	< 0.0104	< 0.0099	< 0.0142		< 0.0115
Concentration, ppm @ 7% O ₂	ppm@7%	< 0.0106	< 0.0101	< 0.0145		< 0.0117
Emission Rate, lb/hr	lb/hr	< 0.00626	< 0.00603	< 0.00853		< 0.00694

APPENDIX A.16
Test Results

Unit 2 FF Outlet
Total Hydrocarbons as Ethane

CONCENTRATION AND EMISSION RATE DATA SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery Facility
Sampling Location	Unit 2 FF Outlet
Operator	13022
Project #	PJJ

Repetition Number	1	2	3	SET AVERAGE
Run Date	08/28/13	08/28/13	08/28/13	
Run Start Time	hh:mm	947	1150	1406
Run Stop Time	hh:mm	1134	1336	1551

Unit 2 FF Outlet	% H ₂ O	18.7	18.4	16.9	18.0
Moisture Content	Mfd	0.813	0.816	0.831	0.820
Dry Mole Fraction	% O ₂	9.918	10.095	10.179	10.064
Oxygen Percentage	% CO ₂	9.516	9.413	9.402	9.444
Carbon Dioxide Percentage	DSCFM	51,153	51,443	48,212	50,269
Dry Standard Stack Flow Rate					

Unit 2 FF Outlet	Fwt	30.06	30.06	30.06	
Total Hydrocarbons (as Ethane)	ppmvw	0.284	0.075	0.097	0.152
Concentration, ppm (wet)	ppmvd	0.349	0.092	0.117	0.186
Concentration, ppm (dry)	ppm@7%O ₂	0.441	0.118	0.152	0.237
Concentration, ppm@12%CO₂	ppm@12%CO ₂	0.440	0.117	0.149	0.235
Emission Rate, lb/hr	lb/hr	0.083	0.022	0.026	0.044

CONCENTRATION AND EMISSION RATE SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery
Sampling Location	Unit 2 FF Outlet
Operator	13022
Project #	PJJ

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	
CEM Run Number	1	2	3	
Run Date	08/28/13	08/28/13	08/28/13	
Run Start Time	hh:mm	947	1025	1110
Run Stop Time	hh:mm	1011	1049	1134
				SET AVERAGE

Unit 2 FF Outlet					
Moisture Content	% H ₂ O	18.8	18.8	18.6	18.7
Dry Mole Fraction	Mfd	0.812	0.812	0.814	0.813
Oxygen Percentage	% O ₂	9.947	9.919	9.888	9.918
Carbon Dioxide Percentage	% CO ₂	9.574	9.432	9.543	9.516
Dry Standard Stack Flow Rate	DSCFM	52,023	52,023	49,413	51,153
Air Flow and Moisture Taken From Test Run =>		2-O-M316-1	2-O-M316-1	2-O-M8-1	

Unit 2 FF Outlet					
Total Hydrocarbons (as Ethane)					
Formula Weight of Ethane	Fwt	30.06	30.06	30.06	
Concentration, ppm (wet)	ppmvw	0.168	0.237	0.456	0.284
Concentration, ppm (dry)	ppmvd	0.195	0.292	0.560	0.349
Concentration, ppm@7%O₂	ppm@7%O ₂	0.247	0.369	0.707	0.441
Concentration, ppm@12%CO₂	ppm@12%CO ₂	0.244	0.371	0.704	0.440
Emission Rate, lb/hr	lb/hr	0.047	0.071	0.130	0.083

CONCENTRATION AND EMISSION RATE SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery
Sampling Location	Unit 2 FF Outlet
Operator	13022
Project #	PJJ

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	
CEM Run Number	4	5	6	
Run Date		08/28/13	08/28/13	08/28/13
Run Start Time	hh:mm	1150	1233	1312
Run Stop Time	hh:mm	1214	1257	1336
				SET AVERAGE

Unit 2 FF Outlet		% H ₂ O	18.6	18.3	18.3	18.4
Moisture Content	Mfd	0.814	0.817	0.817	0.816	
Dry Mole Fraction	% O ₂	9.918	10.199	10.168	10.095	
Oxygen Percentage	% CO ₂	9.500	9.372	9.366	9.413	
Carbon Dioxide Percentage	DSCFM	49,413	52,458	52,458	51,443	
Air Flow and Moisture Taken From Test Run =>		2-O-M8-1	2-O-M8-2	2-O-M8-2		

Unit 2 FF Outlet		Fwt	30.06	30.06	30.06	
Total Hydrocarbons (as Ethane)	ppmvw	0.114	0.067	0.064	0.075	
Concentration, ppm (wet)	ppmvd	0.140	0.070	0.066	0.092	
Concentration, ppm (dry)	ppm@7%O ₂	0.177	0.091	0.086	0.118	
Concentration, ppm@12%CO₂	ppm@12%CO ₂	0.177	0.089	0.085	0.117	
Emission Rate, lb/hr	lb/hr	0.032	0.017	0.016	0.022	

CONCENTRATION AND EMISSION RATE SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery
Sampling Location	Unit 2 FF Outlet
Operator	13022
Project #	PJJ

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	
CEM Run Number	7	8	9	
Run Date	08/28/13	08/28/13	08/28/13	
Run Start Time	hh:mm	1406	1446	1527
Run Stop Time	hh:mm	1430	1510	1551
				SET AVERAGE

Unit 2 FF Outlet					
Moisture Content	% H ₂ O	16.9	16.9	16.9	16.9
Dry Mole Fraction	Mfd	0.831	0.831	0.831	0.831
Oxygen Percentage	% O ₂	10.607	9.827	10.104	10.179
Carbon Dioxide Percentage	% CO ₂	9.180	9.645	9.382	9.402
Dry Standard Stack Flow Rate	DSCFM	48,212	48,212	48,212	48,212
Air Flow and Moisture Taken From Test Run => 2-O-M316-2 2-O-M316-2 2-O-M316-2					

Unit 2 FF Outlet					
Total Hydrocarbons (as Ethane)					
Formula Weight of Ethane	Fwt	30.06	30.06	30.06	
Concentration, ppm (wet)	ppmvw	0.126	0.115	0.050	0.097
Concentration, ppm (dry)	ppmvd	0.152	0.138	0.060	0.117
Concentration, ppm@7%O₂	ppm@7%O ₂	0.205	0.174	0.077	0.152
Concentration, ppm@12%CO₂	ppm@12%CO ₂	0.198	0.172	0.077	0.149
Emission Rate, lb/hr	lb/hr	0.034	0.031	0.014	0.026

APPENDIX A.17
Test Results

Unit 3 SDA Inlet
Hydrogen Chloride

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

MM26

Client Name	Covanta Energy Group, Inc.	Operator	CAN
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 3 SDA Inlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1		SET AVERAGE
Run Number		3-I-MM26-1	3-I-MM26-2	3-I-MM26-3	
Run Date		09/05/13	09/05/13	09/05/13	
Run Start Time	hh:mm	842	1118	1401	
Run Stop Time	hh:mm	1002	1232	1513	

Sampling Parameters

Meter Calibration Factor	Y	1.0052	1.0052	1.0052	
Y _{oA} Calculated by Test Run	Y _{oA}	1.0225	0.9972	0.9979	
Y _{oA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-3.70	-3.70	-3.70	-3.70
Barometric Pressure	in Hg	29.8	29.8	29.8	29.8
Carbon Dioxide Percentage	% CO ₂	9.4	9.2	8.8	9.1
Oxygen Percentage	% O ₂	10.4	10.6	11.0	10.7
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.2	80.2
Total Water Volume Collected	mL	157.5	136.2	119.4	137.7
Sample Volume	ft ³	42.145	39.880	39.850	40.625
Average Meter Temperature	°F	78	74	73	75
Average Delta H	in H ₂ O	1.40	1.20	1.20	1.27
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	7.414	6.411	5.620		6.482
Volume Metered @ STP	DSCF	41.559	39.613	39.645		40.272
Absolute Stack/Duct Pressure	in Hg	29.5	29.5	29.5		29.5
Absolute Meter Pressure	in Hg	29.9	29.9	29.9		29.9
Calculated Stack Moisture	% H ₂ O	15.1	13.9	12.4		13.8

Concentration and Emission Rate Data Summary

Hydrogen Chloride	mg	986	792	964		
Molecular Weight	MW	36.46	36.46	36.46	36.46	
Concentration, ppm	ppm	553	466	567		528
Concentration, ppm @ 12% CO ₂	ppm@12%	706	608	773		695
Concentration, ppm @ 7% O ₂	ppm@7%	732	629	795		719

APPENDIX A.18
Test Results

Unit 3 SDA Inlet
Mercury

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M29

Client Name	Covanta Energy Group, Inc.			Operator	CAN
Plant Name	Huntington Resource Recovery Facility			Project #	13022
Sampling Location	Unit 3 SDA Inlet			Standard Temperature, °F	68
USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE	
Run Number	3-I-M29-1	3-I-M29-2	3-I-M29-3		
Run Date	09/05/13	09/05/13	09/05/13		
Run Start Time	hh:mm	810	1047		1330
Run Stop Time	hh:mm	1026	1301		1542
Sampling Parameters					
Meter Calibration Factor	Y	0.9919	0.9919	0.9919	
Y _{OA} Calculated by Test Run	Y _{OA}	0.9875	0.9916	0.9860	
Y _{OA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-3.70	-3.70	-3.70	-3.70
Stack Cross-Sectional Area	ft ²	23.758	23.758	23.758	23.758
Barometric Pressure	in Hg	29.8	29.8	29.8	29.8
Actual Nozzle Diameter	in	0.231	0.236	0.231	
Carbon Dioxide Percentage	% CO ₂	9.4	9.2	8.8	9.1
Oxygen Percentage	% O ₂	10.4	10.6	11.0	10.7
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.2	80.2
Total Water Volume Collected	mL	245.5	242.5	244.0	244.0
Sample Volume	ft ³	69.110	72.740	70.870	70.907
Average Meter Temperature	°F	83	80	77	80
Average Stack Temperature	°F	453	458	464	459
Average Delta H	in H ₂ O	0.96	1.08	1.02	1.02
Total Sampling Time	min	120	120	120	120
Air Flow Parameters					
Volume of Water vapor @ STP	SCF	11.556	11.414	11.485	11.485
Volume Metered @ STP	DSCF	66.553	70.466	68.951	68.657
Absolute Stack/Duct Pressure	in Hg	29.5	29.5	29.5	29.5
Absolute Meter Pressure	in Hg	29.9	29.9	29.9	29.9
Calculated Stack Moisture	% H ₂ O	14.8	13.9	14.3	14.3
Dry Mole Fraction	decimal	0.852	0.861	0.857	0.857
Avg Square of Differential Pressure	in H ₂ O	0.868	0.870	0.881	0.873
Avg Square of Diff. Pres., Squared	in H ₂ O	0.753	0.758	0.776	0.762
Dry Gas Molecular Weight	lb/lb-mole	29.92	29.90	29.85	29.89
Wet Stack Gas Molecular Weight	lb/lb-mole	28.16	28.24	28.16	28.18
Average Stack Gas Velocity	ft/sec	65.32	65.59	66.71	65.87
Percent of Isokinetic Rate	% ISO	100.0	100.6	102.1	100.9
Air Flow Rate Results					
Actual Stack Flow/Minute	ACFM	93,106	93,499	95,099	93,901
Dry Standard Stack Flow/Minute	DSCFM	45,271	45,661	45,960	45,631
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	34,197	33,835	32,734	33,589

Concentration and Emission Rate Data Summary						
Mercury (Hg)	ug	< 133.165	< 41.105	< 37.650	<	70.640
Concentration, ug/DSCM	ug/DSCM	< 70.7	< 20.6	< 19.3	<	36.8
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 90.2	< 26.9	< 26.3	<	47.8
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 93.5	< 27.8	< 27.1	<	49.5
Concentration MilliGr/DSCF	mGr/DSCF	< 3.09E-02	< 9.00E-03	< 8.43E-03	<	1.61E-02
Concentration MilliGr/DSCF @ 12% CO ₂	mGr@12%	< 3.94E-02	< 1.17E-02	< 1.15E-02	<	2.09E-02
Concentration MilliGr/DSCF @ 7% O ₂	mGr@7%	< 4.09E-02	< 1.21E-02	< 1.18E-02	<	2.16E-02
Emission Rate, lb/hr	lb/hr	< 1.20E-02	< 3.52E-03	< 3.32E-03	<	6.27E-03

APPENDIX A.19
Test Results

Unit 3 FF Outlet
Ammonia, Hydrogen Chloride, and Hydrogen Fluoride

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M26A

Client Name	Covanta Energy Group, Inc.	Operator	GLW
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 3 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number		3-O-M26A-1	3-O-M26A-2	
Run Date		09/05/13	09/05/13	
Run Start Time	hh:mm	841	1118	
Run Stop Time	hh:mm	1002	1232	1513

Sampling Parameters

Meter Calibration Factor	Y	1.0077	1.0077	1.0077	
Y _{QA} Calculated by Test Run	Y _{QA}	0.9851	0.9884	1.0103	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-14.70	-16.20	-15.30	-15.40
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.8	29.8	29.8	29.8
Actual Nozzle Diameter	in	0.212	0.210	0.212	
Carbon Dioxide Percentage	% CO ₂	8.8	7.9	8.0	8.2
Oxygen Percentage	% O ₂	11.0	11.9	11.8	11.6
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.2	80.2
Total Water Volume Collected	mL	158.3	162.0	155.5	158.6
Sample Volume	ft ³	35.512	34.412	33.795	34.573
Average Meter Temperature	°F	78	79	81	79
Average Stack Temperature	°F	293	292	292	292
Average Delta H	in H ₂ O	1.01	0.94	0.95	0.96
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	7.451	7.625	7.319	7.465
Volume Metered @ STP	DSCF	35.055	33.903	33.179	34.046
Absolute Stack/Duct Pressure	in Hg	28.7	28.6	28.7	28.7
Absolute Meter Pressure	in Hg	29.9	29.9	29.9	29.9
Calculated Stack Moisture	% H ₂ O	17.5	18.4	18.1	18.0
Saturated Stack Moisture	% H ₂ O	100.0	100.0	100.0	100.0
Reported Stack Moisture Content	% H ₂ O	17.5	18.4	18.1	18.0
Dry Mole Fraction	decimal	0.825	0.816	0.819	0.820
Avg Square of Differential Pressure	in H ₂ O	0.988	0.974	0.956	0.972
Avg Square of Diff. Pres., Squared	in H ₂ O	0.975	0.948	0.914	0.946
Dry Gas Molecular Weight	lb/lb-mole	29.85	29.74	29.75	29.78
Wet Stack Gas Molecular Weight	lb/lb-mole	27.77	27.58	27.63	27.66
Average Stack Gas Velocity	ft/sec	68.90	68.27	66.88	68.01
Percent of Isokinetic Rate	% ISO	103.9	104.7	102.0	103.5

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	89,496	88,670	86,864	88,343
Dry Standard Stack Flow/Minute	DSCFM	49,693	48,585	47,898	48,725
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	35,393	31,458	31,358	32,736

Concentration and Emission Rate Data Summary					
Ammonia	mg	2.18	1.87	1.85	
Molecular Weight	MW	17.01	17.01	17.01	17.01
Concentration, ppm	ppm	3.11	2.75	2.78	2.88
Concentration, ppm @ 12% CO ₂	ppm@12%	4.23	4.18	4.18	4.20
Concentration, ppm @ 7% O ₂	ppm@7%	4.36	4.25	4.25	4.29
Emission Rate, lb/hr	lb/hr	0.409	0.354	0.353	0.372
Hydrogen Chloride	mg	1.77	1.92	2.68	
Molecular Weight	MW	36.46	36.46	36.46	36.46
Concentration, ppm	ppm	1.18	1.32	1.88	1.46
Concentration, ppm @ 12% CO ₂	ppm@12%	1.60	2.00	2.82	2.14
Concentration, ppm @ 7% O ₂	ppm@7%	1.65	2.04	2.87	2.19
Emission Rate, lb/hr	lb/hr	0.332	0.364	0.512	0.403
Hydrogen Fluoride	mg	< 0.046	< 0.045	< 0.047	
Molecular Weight	MW	20.01	20.01	20.01	20.01
Concentration, ppm	ppm	< 0.0557	< 0.0563	< 0.0601	< 0.0574
Concentration, ppm @ 12% CO ₂	ppm@12%	< 0.0760	< 0.0856	< 0.0902	< 0.0839
Concentration, ppm @ 7% O ₂	ppm@7%	< 0.0782	< 0.0870	< 0.0919	< 0.0857
Emission Rate, lb/hr	lb/hr	< 0.00863	< 0.00853	< 0.00898	< 0.00871

Removal Efficiency Summary For:

HC

Unit #	Repetition Number	ppm @ 7 % O2		Removal Efficiency, %
		Inlet Result	Outlet Result	
3	1	732	1.65	99.8%
	2	629	2.04	99.7%
	3	795	2.87	99.6%
AVERAGE =>				99.7%

APPENDIX A.20
Test Results

Unit 3 FF Outlet
Dioxins/Furans, PAHS, and PCBs

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

23

Client Name	Covanta Energy Group, Inc.	Operator	CMW
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 3 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number	3-O-M23-1	3-O-M23-2	3-O-M23-3	
Run Date	08/27/13	08/27/13	08/28/13	
Run Start Time	hh:mm	830	1317	
Run Stop Time	hh:mm	1252	1721	1224

Sampling Parameters

Meter Calibration Factor	Y	1.0077	1.0077	1.0077	
Y_{QA} Calculated by Test Run	Y _{QA}	1.0151	0.9904	1.0153	
Y_{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-15.00	-15.00	-15.00	-15.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.7	29.7	29.7	29.7
Actual Nozzle Diameter	in	0.212	0.210	0.212	
Carbon Dioxide Percentage	% CO ₂	8.6	8.6	8.3	8.5
Oxygen Percentage	% O ₂	11.2	11.2	11.3	11.2
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.4	80.3
Total Water Volume Collected	mL	626.4	623.8	527.7	592.6
Sample Volume	ft ³	126.550	127.034	130.384	127.989
Average Meter Temperature	°F	78	86	90	85
Average Stack Temperature	°F	293	293	294	294
Average Delta H	in H ₂ O	0.85	0.80	0.88	0.84
Total Sampling Time	min	240	240	240	240

Air Flow Parameters

Volume of Water vapor @ STP	SCF	29.485	29.362	24.839	27.895
Volume Metered @ STP	DSCF	124.465	122.973	125.423	124.287
Absolute Stack/Duct Pressure	in Hg	28.6	28.6	28.6	28.6
Absolute Meter Pressure	in Hg	29.8	29.8	29.8	29.8
Calculated Stack Moisture	% H ₂ O	19.2	19.3	16.5	18.3
Saturated Stack Moisture	% H ₂ O	100.0	100.0	100.0	100.0
Reported Stack Moisture Content	% H ₂ O	19.2	19.3	16.5	18.3
Dry Mole Fraction	decimal	0.808	0.807	0.835	0.817
Avg Square of Differential Pressure	in H ₂ O	0.929	0.920	0.946	0.932
Avg Square of Diff. Pres., Squared	in H ₂ O	0.863	0.846	0.895	0.868
Dry Gas Molecular Weight	lb/lb-mole	29.82	29.82	29.78	29.81
Wet Stack Gas Molecular Weight	lb/lb-mole	27.56	27.54	27.83	27.65
Average Stack Gas Velocity	ft/sec	65.21	64.62	66.13	65.32
Percent of Isokinetic Rate	% ISO	99.8	101.7	96.2	99.2

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	84,706	83,931	85,898	84,845
Dry Standard Stack Flow/Minute	DSCFM	45,897	45,380	47,983	46,420
Dry Standard Flow/Minute @ 7% O₂	DSCFM7	32,029	31,668	33,139	32,279

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Concentration and Emission Rate Data Summary					
2,3,7,8-TCDD	pg	10.90	2.67	3.03	5.53
Concentration, ng/DSCM	ng/DSCM	3.09E-03	7.67E-04	8.53E-04	1.57E-03
Concen., ng/DSCM @ 12% CO ₂	ng@12%	4.31E-03	1.07E-03	1.23E-03	2.21E-03
Concen., ng/DSCM @ 7% O ₂	ng@7%	4.43E-03	1.10E-03	1.24E-03	2.25E-03
Emission Rate, lb/hr	lb/hr	5.32E-10	1.30E-10	1.53E-10	2.72E-10
Emission Rate, grams/second	g/s	6.70E-11	1.64E-11	1.93E-11	3.42E-11
Other TCDD	pg	286.10	256.33	240.97	261.13
Concentration, ng/DSCM	ng/DSCM	8.12E-02	7.36E-02	6.78E-02	7.42E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.13E-01	1.03E-01	9.81E-02	1.05E-01
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.16E-01	1.05E-01	9.82E-02	1.07E-01
Emission Rate, lb/hr	lb/hr	1.40E-08	1.25E-08	1.22E-08	1.29E-08
Emission Rate, grams/second	g/s	1.76E-09	1.58E-09	1.54E-09	1.62E-09
1,2,3,7,8-PeCDD	pg	29.80	10.40	10.00	16.73
Concentration, ng/DSCM	ng/DSCM	8.45E-03	2.99E-03	2.82E-03	4.75E-03
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.18E-02	4.17E-03	4.07E-03	6.68E-03
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.21E-02	4.28E-03	4.08E-03	6.82E-03
Emission Rate, lb/hr	lb/hr	1.45E-09	5.08E-10	5.06E-10	8.22E-10
Emission Rate, grams/second	g/s	1.83E-10	6.40E-11	6.38E-11	1.04E-10
Other PeCDD	pg	365.20	348.60	322.00	345.27
Concentration, ng/DSCM	ng/DSCM	1.04E-01	1.00E-01	9.07E-02	9.81E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.45E-01	1.40E-01	1.31E-01	1.38E-01
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.48E-01	1.43E-01	1.31E-01	1.41E-01
Emission Rate, lb/hr	lb/hr	1.78E-08	1.70E-08	1.63E-08	1.70E-08
Emission Rate, grams/second	g/s	2.24E-09	2.14E-09	2.05E-09	2.15E-09
1,2,3,4,7,8-HxCDD	pg	21.00	11.10	9.78	13.96
Concentration, ng/DSCM	ng/DSCM	5.96E-03	3.19E-03	2.75E-03	3.97E-03
Concen., ng/DSCM @ 12% CO ₂	ng@12%	8.31E-03	4.45E-03	3.98E-03	5.58E-03
Concen., ng/DSCM @ 7% O ₂	ng@7%	8.54E-03	4.57E-03	3.99E-03	5.70E-03
Emission Rate, lb/hr	lb/hr	1.02E-09	5.42E-10	4.95E-10	6.87E-10
Emission Rate, grams/second	g/s	1.29E-10	6.83E-11	6.24E-11	8.66E-11
1,2,3,6,7,8-HxCDD	pg	46.00	31.80	25.60	34.47
Concentration, ng/DSCM	ng/DSCM	1.30E-02	9.13E-03	7.21E-03	9.80E-03
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.82E-02	1.27E-02	1.04E-02	1.38E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.87E-02	1.31E-02	1.04E-02	1.41E-02
Emission Rate, lb/hr	lb/hr	2.24E-09	1.55E-09	1.30E-09	1.70E-09
Emission Rate, grams/second	g/s	2.83E-10	1.96E-10	1.63E-10	2.14E-10
1,2,3,7,8,9-HxCDD	pg	34.20	17.60	12.60	21.47
Concentration, ng/DSCM	ng/DSCM	9.70E-03	5.05E-03	3.55E-03	6.10E-03
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.35E-02	7.05E-03	5.13E-03	8.57E-03
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.39E-02	7.24E-03	5.14E-03	8.76E-03
Emission Rate, lb/hr	lb/hr	1.67E-09	8.59E-10	6.38E-10	1.05E-09
Emission Rate, grams/second	g/s	2.10E-10	1.08E-10	8.03E-11	1.33E-10

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Other HxCDD	pg	527.80	536.50	447.02		503.77
Concentration, ng/DSCM	ng/DSCM	1.50E-01	1.54E-01	1.26E-01		1.43E-01
Concen., ng/DSCM @ 12% CO ₂	ng@12%	2.09E-01	2.15E-01	1.82E-01		2.02E-01
Concen., ng/DSCM @ 7% O ₂	ng@7%	2.15E-01	2.21E-01	1.82E-01		2.06E-01
Emission Rate, lb/hr	lb/hr	2.57E-08	2.62E-08	2.26E-08		2.49E-08
Emission Rate, grams/second	g/s	3.24E-09	3.30E-09	2.85E-09		3.13E-09

1,2,3,4,6,7,8-HpCDD	pg	295.00	205.00	152.00		217.33
Concentration, ng/DSCM	ng/DSCM	8.37E-02	5.89E-02	4.28E-02		6.18E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.17E-01	8.21E-02	6.19E-02		8.69E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.20E-01	8.43E-02	6.20E-02		8.87E-02
Emission Rate, lb/hr	lb/hr	1.44E-08	1.00E-08	7.69E-09		1.07E-08
Emission Rate, grams/second	g/s	1.81E-09	1.26E-09	9.69E-10		1.35E-09

Other HpCDD	pg	254.00	198.00	161.00		204.33
Concentration, ng/DSCM	ng/DSCM	7.21E-02	5.69E-02	4.53E-02		5.81E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.01E-01	7.93E-02	6.55E-02		8.18E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.03E-01	8.15E-02	6.56E-02		8.35E-02
Emission Rate, lb/hr	lb/hr	1.24E-08	9.67E-09	8.15E-09		1.01E-08
Emission Rate, grams/second	g/s	1.56E-09	1.22E-09	1.03E-09		1.27E-09

OCDD	pg	485.00	312.00	234.00		343.67
Concentration, ng/DSCM	ng/DSCM	1.38E-01	8.96E-02	6.59E-02		9.77E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.92E-01	1.25E-01	9.52E-02		1.37E-01
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.97E-01	1.28E-01	9.54E-02		1.40E-01
Emission Rate, lb/hr	lb/hr	2.37E-08	1.52E-08	1.18E-08		1.69E-08
Emission Rate, grams/second	g/s	2.98E-09	1.92E-09	1.49E-09		2.13E-09

2,3,7,8-TCDF	pg	47.10	15.20	16.30		26.20
Concentration, ng/DSCM	ng/DSCM	1.34E-02	4.36E-03	4.59E-03		7.44E-03
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.86E-02	6.09E-03	6.63E-03		1.05E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.91E-02	6.25E-03	6.64E-03		1.07E-02
Emission Rate, lb/hr	lb/hr	2.30E-09	7.42E-10	8.25E-10		1.29E-09
Emission Rate, grams/second	g/s	2.89E-10	9.35E-11	1.04E-10		1.62E-10

Other TCDF	pg	1032.90	457.80	517.70		669.47
Concentration, ng/DSCM	ng/DSCM	2.93E-01	1.31E-01	1.46E-01		1.90E-01
Concen., ng/DSCM @ 12% CO ₂	ng@12%	4.09E-01	1.83E-01	2.11E-01		2.68E-01
Concen., ng/DSCM @ 7% O ₂	ng@7%	4.20E-01	1.88E-01	2.11E-01		2.73E-01
Emission Rate, lb/hr	lb/hr	5.04E-08	2.23E-08	2.62E-08		3.30E-08
Emission Rate, grams/second	g/s	6.35E-09	2.82E-09	3.30E-09		4.15E-09

1,2,3,7,8-PeCDF	pg	90.70	25.30	29.70		48.57
Concentration, ng/DSCM	ng/DSCM	2.57E-02	7.26E-03	8.36E-03		1.38E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	3.59E-02	1.01E-02	1.21E-02		1.94E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	3.69E-02	1.04E-02	1.21E-02		1.98E-02
Emission Rate, lb/hr	lb/hr	4.42E-09	1.23E-09	1.50E-09		2.39E-09
Emission Rate, grams/second	g/s	5.57E-10	1.56E-10	1.89E-10		3.01E-10

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

2,3,4,7,8-PeCDF	pg	81.20	29.90	28.90		46.67
Concentration, ng/DSCM	ng/DSCM	2.30E-02	8.59E-03	8.14E-03		1.33E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	3.21E-02	1.20E-02	1.18E-02		1.86E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	3.30E-02	1.23E-02	1.18E-02		1.90E-02
Emission Rate, lb/hr	lb/hr	3.96E-09	1.46E-09	1.46E-09		2.29E-09
Emission Rate, grams/second	g/s	4.99E-10	1.84E-10	1.84E-10		2.89E-10

Other PeCDF	pg	868.10	352.80	393.40		538.10
Concentration, ng/DSCM	ng/DSCM	2.46E-01	1.01E-01	1.11E-01		1.53E-01
Concen., ng/DSCM @ 12% CO ₂	ng@12%	3.44E-01	1.41E-01	1.60E-01		2.15E-01
Concen., ng/DSCM @ 7% O ₂	ng@7%	3.53E-01	1.45E-01	1.60E-01		2.19E-01
Emission Rate, lb/hr	lb/hr	4.23E-08	1.72E-08	1.99E-08		2.65E-08
Emission Rate, grams/second	g/s	5.34E-09	2.17E-09	2.51E-09		3.34E-09

1,2,3,4,7,8-HxCDF	pg	93.70	28.80	22.50		48.33
Concentration, ng/DSCM	ng/DSCM	2.66E-02	8.27E-03	6.33E-03		1.37E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	3.71E-02	1.15E-02	9.16E-03		1.93E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	3.81E-02	1.19E-02	9.17E-03		1.97E-02
Emission Rate, lb/hr	lb/hr	4.57E-09	1.41E-09	1.14E-09		2.37E-09
Emission Rate, grams/second	g/s	5.76E-10	1.77E-10	1.43E-10		2.99E-10

1,2,3,6,7,8-HxCDF	pg	104.00	30.30	29.80		54.70
Concentration, ng/DSCM	ng/DSCM	2.95E-02	8.70E-03	8.39E-03		1.55E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	4.12E-02	1.21E-02	1.21E-02		2.18E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	4.23E-02	1.25E-02	1.21E-02		2.23E-02
Emission Rate, lb/hr	lb/hr	5.07E-09	1.48E-09	1.51E-09		2.69E-09
Emission Rate, grams/second	g/s	6.39E-10	1.86E-10	1.90E-10		3.39E-10

2,3,4,6,7,8-HxCDF	pg	76.60	31.50	28.90		45.67
Concentration, ng/DSCM	ng/DSCM	2.17E-02	9.04E-03	8.14E-03		1.30E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	3.03E-02	1.26E-02	1.18E-02		1.82E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	3.11E-02	1.30E-02	1.18E-02		1.86E-02
Emission Rate, lb/hr	lb/hr	3.74E-09	1.54E-09	1.46E-09		2.25E-09
Emission Rate, grams/second	g/s	4.71E-10	1.94E-10	1.84E-10		2.83E-10

1,2,3,7,8,9-HxCDF	pg	0.00	0.00	0.00		0.00
Concentration, ng/DSCM	ng/DSCM	0.00E+00	0.00E+00	0.00E+00		0.00E+00
Concen., ng/DSCM @ 12% CO ₂	ng@12%	0.00E+00	0.00E+00	0.00E+00		0.00E+00
Concen., ng/DSCM @ 7% O ₂	ng@7%	0.00E+00	0.00E+00	0.00E+00		0.00E+00
Emission Rate, lb/hr	lb/hr	0.00E+00	0.00E+00	0.00E+00		0.00E+00
Emission Rate, grams/second	g/s	0.00E+00	0.00E+00	0.00E+00		0.00E+00

Other HxCDF	pg	472.70	186.40	173.80		277.63
Concentration, ng/DSCM	ng/DSCM	1.34E-01	5.35E-02	4.89E-02		7.89E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.87E-01	7.47E-02	7.07E-02		1.11E-01
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.92E-01	7.67E-02	7.08E-02		1.13E-01
Emission Rate, lb/hr	lb/hr	2.31E-08	9.10E-09	8.80E-09		1.37E-08
Emission Rate, grams/second	g/s	2.91E-09	1.15E-09	1.11E-09		1.72E-09

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

1,2,3,4,6,7,8-HpCDF	pg	210.00	75.50	58.70		114.73
Concentration, ng/DSCM	ng/DSCM	5.96E-02	2.17E-02	1.65E-02		3.26E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	8.31E-02	3.02E-02	2.39E-02		4.58E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	8.54E-02	3.11E-02	2.39E-02		4.68E-02
Emission Rate, lb/hr	lb/hr	1.02E-08	3.69E-09	2.97E-09		5.63E-09
Emission Rate, grams/second	g/s	1.29E-09	4.64E-10	3.74E-10		7.10E-10

1,2,3,4,7,8,9-HpCDF	pg	40.20	14.10	8.10		20.80
Concentration, ng/DSCM	ng/DSCM	1.14E-02	4.05E-03	2.28E-03		5.91E-03
Concen., ng/DSCM @ 12% CO ₂	ng@12%	1.59E-02	5.65E-03	3.30E-03		8.29E-03
Concen., ng/DSCM @ 7% O ₂	ng@7%	1.63E-02	5.80E-03	3.30E-03		8.48E-03
Emission Rate, lb/hr	lb/hr	1.96E-09	6.88E-10	4.10E-10		1.02E-09
Emission Rate, grams/second	g/s	2.47E-10	8.67E-11	5.16E-11		1.28E-10

Other HpCDF	pg	101.80	46.40	30.30		59.50
Concentration, ng/DSCM	ng/DSCM	2.89E-02	1.33E-02	8.53E-03		1.69E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	4.03E-02	1.86E-02	1.23E-02		2.37E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	4.14E-02	1.91E-02	1.24E-02		2.43E-02
Emission Rate, lb/hr	lb/hr	4.97E-09	2.26E-09	1.53E-09		2.92E-09
Emission Rate, grams/second	g/s	6.26E-10	2.85E-10	1.93E-10		3.68E-10

OCDF	pg	84.60	45.70	22.90		51.07
Concentration, ng/DSCM	ng/DSCM	2.40E-02	1.31E-02	6.45E-03		1.45E-02
Concen., ng/DSCM @ 12% CO ₂	ng@12%	3.35E-02	1.83E-02	9.32E-03		2.04E-02
Concen., ng/DSCM @ 7% O ₂	ng@7%	3.44E-02	1.88E-02	9.33E-03		2.08E-02
Emission Rate, lb/hr	lb/hr	4.13E-09	2.23E-09	1.16E-09		2.51E-09
Emission Rate, grams/second	g/s	5.20E-10	2.81E-10	1.46E-10		3.16E-10

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-1

Congener	UNITY	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	3.09E-03	4.31E-03	4.43E-03	5.32E-10	3.98E-12
Other TCDD	1	8.12E-02	1.13E-01	1.16E-01	1.40E-08	1.04E-10
1,2,3,7,8-PeCDD	1	8.45E-03	1.18E-02	1.21E-02	1.45E-09	1.09E-11
Other PeCDD	1	1.04E-01	1.45E-01	1.48E-01	1.78E-08	1.33E-10
1,2,3,4,7,8-HxCDD	1	5.96E-03	8.31E-03	8.54E-03	1.02E-09	7.67E-12
1,2,3,6,7,8-HxCDD	1	1.30E-02	1.82E-02	1.87E-02	2.24E-09	1.68E-11
1,2,3,7,8,9-HxCDD	1	9.70E-03	1.35E-02	1.39E-02	1.67E-09	1.25E-11
Other HxCDD	1	1.50E-01	2.09E-01	2.15E-01	2.57E-08	1.93E-10
1,2,3,4,6,7,8-HpCDD	1	8.37E-02	1.17E-01	1.20E-01	1.44E-08	1.08E-10
Other HpCDD	1	7.21E-02	1.01E-01	1.03E-01	1.24E-08	9.28E-11
OCDD	1	1.38E-01	1.92E-01	1.97E-01	2.37E-08	1.77E-10
TOTAL PCDD		6.68E-01	9.32E-01	9.57E-01	1.15E-07	8.60E-10
2,3,7,8-TCDF	1	1.34E-02	1.86E-02	1.91E-02	2.30E-09	1.72E-11
Other TCDF	1	2.93E-01	4.09E-01	4.20E-01	5.04E-08	3.77E-10
1,2,3,7,8-PeCDF	1	2.57E-02	3.59E-02	3.69E-02	4.42E-09	3.31E-11
2,3,4,7,8-PeCDF	1	2.30E-02	3.21E-02	3.30E-02	3.96E-09	2.97E-11
Other PeCDF	1	2.46E-01	3.44E-01	3.53E-01	4.23E-08	3.17E-10
1,2,3,4,7,8-HxCDF	1	2.66E-02	3.71E-02	3.81E-02	4.57E-09	3.42E-11
1,2,3,6,7,8-HxCDF	1	2.95E-02	4.12E-02	4.23E-02	5.07E-09	3.80E-11
2,3,4,6,7,8-HxCDF	1	2.17E-02	3.03E-02	3.11E-02	3.74E-09	2.80E-11
1,2,3,7,8,9-HxCDF	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	1	1.34E-01	1.87E-01	1.92E-01	2.31E-08	1.73E-10
1,2,3,4,6,7,8-HpCDF	1	5.96E-02	8.31E-02	8.54E-02	1.02E-08	7.67E-11
1,2,3,4,7,8,9-HpCDF	1	1.14E-02	1.59E-02	1.63E-02	1.96E-09	1.47E-11
Other HpCDF	1	2.89E-02	4.03E-02	4.14E-02	4.97E-09	3.72E-11
OCDF	1	2.40E-02	3.35E-02	3.44E-02	4.13E-09	3.09E-11
TOTAL PCDF		9.37E-01	1.31E+00	1.34E+00	1.61E-07	1.21E-09
TOTAL PCDD/PCDF		1.61E+00	2.24E+00	2.30E+00	2.76E-07	2.07E-09

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-2

Congener	UNITY	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	7.67E-04	1.07E-03	1.10E-03	1.30E-10	9.87E-13
Other TCDD	1	7.36E-02	1.03E-01	1.05E-01	1.25E-08	9.48E-11
1,2,3,7,8-PeCDD	1	2.99E-03	4.17E-03	4.28E-03	5.08E-10	3.84E-12
Other PeCDD	1	1.00E-01	1.40E-01	1.43E-01	1.70E-08	1.29E-10
1,2,3,4,7,8-HxCDD	1	3.19E-03	4.45E-03	4.57E-03	5.42E-10	4.10E-12
1,2,3,6,7,8-HxCDD	1	9.13E-03	1.27E-02	1.31E-02	1.55E-09	1.18E-11
1,2,3,7,8,9-HxCDD	1	5.05E-03	7.05E-03	7.24E-03	8.59E-10	6.51E-12
Other HxCDD	1	1.54E-01	2.15E-01	2.21E-01	2.62E-08	1.98E-10
1,2,3,4,6,7,8-HpCDD	1	5.89E-02	8.21E-02	8.43E-02	1.00E-08	7.58E-11
Other HpCDD	1	5.69E-02	7.93E-02	8.15E-02	9.67E-09	7.32E-11
OCDD	1	8.96E-02	1.25E-01	1.28E-01	1.52E-08	1.15E-10
TOTAL PCDD		5.54E-01	7.73E-01	7.94E-01	9.42E-08	7.13E-10
2,3,7,8-TCDF	1	4.36E-03	6.09E-03	6.25E-03	7.42E-10	5.62E-12
Other TCDF	1	1.31E-01	1.83E-01	1.88E-01	2.23E-08	1.69E-10
1,2,3,7,8-PeCDF	1	7.26E-03	1.01E-02	1.04E-02	1.23E-09	9.35E-12
2,3,4,7,8-PeCDF	1	8.59E-03	1.20E-02	1.23E-02	1.46E-09	1.11E-11
Other PeCDF	1	1.01E-01	1.41E-01	1.45E-01	1.72E-08	1.30E-10
1,2,3,4,7,8-HxCDF	1	8.27E-03	1.15E-02	1.19E-02	1.41E-09	1.06E-11
1,2,3,6,7,8-HxCDF	1	8.70E-03	1.21E-02	1.25E-02	1.48E-09	1.12E-11
2,3,4,6,7,8-HxCDF	1	9.04E-03	1.26E-02	1.30E-02	1.54E-09	1.16E-11
1,2,3,7,8,9-HxCDF	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	1	5.35E-02	7.47E-02	7.67E-02	9.10E-09	6.89E-11
1,2,3,4,6,7,8-HpCDF	1	2.17E-02	3.02E-02	3.11E-02	3.69E-09	2.79E-11
1,2,3,4,7,8,9-HpCDF	1	4.05E-03	5.65E-03	5.80E-03	6.88E-10	5.21E-12
Other HpCDF	1	1.33E-02	1.86E-02	1.91E-02	2.26E-09	1.72E-11
OCDF	1	1.31E-02	1.83E-02	1.88E-02	2.23E-09	1.69E-11
TOTAL PCDF		3.85E-01	5.37E-01	5.51E-01	6.54E-08	4.95E-10
TOTAL PCDD/PCDF		9.39E-01	1.31E+00	1.35E+00	1.60E-07	1.21E-09

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-3

Congener	UNITY	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	Ib/hr	Ib/MMBtu
2,3,7,8-TCDD	1	8.53E-04	1.23E-03	1.24E-03	1.53E-10	1.11E-12
Other TCDD	1	6.78E-02	9.81E-02	9.82E-02	1.22E-08	8.83E-11
1,2,3,7,8-PeCDD	1	2.82E-03	4.07E-03	4.08E-03	5.06E-10	3.66E-12
Other PeCDD	1	9.07E-02	1.31E-01	1.31E-01	1.63E-08	1.18E-10
1,2,3,4,7,8-HxCDD	1	2.75E-03	3.98E-03	3.99E-03	4.95E-10	3.58E-12
1,2,3,6,7,8-HxCDD	1	7.21E-03	1.04E-02	1.04E-02	1.30E-09	9.38E-12
1,2,3,7,8,9-HxCDD	1	3.55E-03	5.13E-03	5.14E-03	6.38E-10	4.61E-12
Other HxCDD	1	1.26E-01	1.82E-01	1.82E-01	2.26E-08	1.64E-10
1,2,3,4,6,7,8-HpCDD	1	4.28E-02	6.19E-02	6.20E-02	7.69E-09	5.57E-11
Other HpCDD	1	4.53E-02	6.55E-02	6.56E-02	8.15E-09	5.90E-11
OCDD	1	6.59E-02	9.52E-02	9.54E-02	1.18E-08	8.57E-11
TOTAL PCDD		4.56E-01	6.59E-01	6.60E-01	8.19E-08	5.93E-10
2,3,7,8-TCDF	1	4.59E-03	6.63E-03	6.64E-03	8.25E-10	5.97E-12
Other TCDF	1	1.46E-01	2.11E-01	2.11E-01	2.62E-08	1.90E-10
1,2,3,7,8-PeCDF	1	8.36E-03	1.21E-02	1.21E-02	1.50E-09	1.09E-11
2,3,4,7,8-PeCDF	1	8.14E-03	1.18E-02	1.18E-02	1.46E-09	1.06E-11
Other PeCDF	1	1.11E-01	1.60E-01	1.60E-01	1.99E-08	1.44E-10
1,2,3,4,7,8-HxCDF	1	6.33E-03	9.16E-03	9.17E-03	1.14E-09	8.24E-12
1,2,3,6,7,8-HxCDF	1	8.39E-03	1.21E-02	1.21E-02	1.51E-09	1.09E-11
2,3,4,6,7,8-HxCDF	1	8.14E-03	1.18E-02	1.18E-02	1.46E-09	1.06E-11
1,2,3,7,8,9-HxCDF	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	1	4.89E-02	7.07E-02	7.08E-02	8.80E-09	6.37E-11
1,2,3,4,6,7,8-HpCDF	1	1.65E-02	2.39E-02	2.39E-02	2.97E-09	2.15E-11
1,2,3,4,7,8,9-HpCDF	1	2.28E-03	3.30E-03	3.30E-03	4.10E-10	2.97E-12
Other HpCDF	1	8.53E-03	1.23E-02	1.24E-02	1.53E-09	1.11E-11
OCDF	1	6.45E-03	9.32E-03	9.33E-03	1.16E-09	8.39E-12
TOTAL PCDF		3.83E-01	5.54E-01	5.55E-01	6.89E-08	4.98E-10
TOTAL PCDD/PCDF		8.39E-01	1.21E+00	1.21E+00	1.51E-07	1.09E-09

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Average Concentration and Emission Rate Summary

Congener	UNITY	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	1.57E-03	2.21E-03	2.25E-03	2.72E-10	2.03E-12
Other TCDD	1	7.42E-02	1.05E-01	1.07E-01	1.29E-08	9.58E-11
1,2,3,7,8-PeCDD	1	4.75E-03	6.68E-03	6.82E-03	8.22E-10	6.13E-12
Other PeCDD	1	9.81E-02	1.38E-01	1.41E-01	1.70E-08	1.27E-10
1,2,3,4,7,8-HxCDD	1	3.97E-03	5.58E-03	5.70E-03	6.87E-10	5.12E-12
1,2,3,6,7,8-HxCDD	1	9.80E-03	1.38E-02	1.41E-02	1.70E-09	1.26E-11
1,2,3,7,8,9-HxCDD	1	6.10E-03	8.57E-03	8.76E-03	1.05E-09	7.87E-12
Other HxCDD	1	1.43E-01	2.02E-01	2.06E-01	2.49E-08	1.85E-10
1,2,3,4,6,7,8-HpCDD	1	6.18E-02	8.69E-02	8.87E-02	1.07E-08	7.97E-11
Other HpCDD	1	5.81E-02	8.18E-02	8.35E-02	1.01E-08	7.50E-11
OCDD	1	9.77E-02	1.37E-01	1.40E-01	1.69E-08	1.26E-10
TOTAL PCDD		5.59E-01	7.88E-01	8.04E-01	9.70E-08	7.22E-10
2,3,7,8-TCDF	1	7.44E-03	1.05E-02	1.07E-02	1.29E-09	9.60E-12
Other TCDF	1	1.90E-01	2.68E-01	2.73E-01	3.30E-08	2.45E-10
1,2,3,7,8-PeCDF	1	1.38E-02	1.94E-02	1.98E-02	2.39E-09	1.78E-11
2,3,4,7,8-PeCDF	1	1.33E-02	1.86E-02	1.90E-02	2.29E-09	1.71E-11
Other PeCDF	1	1.53E-01	2.15E-01	2.19E-01	2.65E-08	1.97E-10
1,2,3,4,7,8-HxCDF	1	1.37E-02	1.93E-02	1.97E-02	2.37E-09	1.77E-11
1,2,3,6,7,8-HxCDF	1	1.55E-02	2.18E-02	2.23E-02	2.69E-09	2.00E-11
2,3,4,6,7,8-HxCDF	1	1.30E-02	1.82E-02	1.86E-02	2.25E-09	1.67E-11
1,2,3,7,8,9-HxCDF	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	1	7.89E-02	1.11E-01	1.13E-01	1.37E-08	1.02E-10
1,2,3,4,6,7,8-HpCDF	1	3.26E-02	4.58E-02	4.68E-02	5.63E-09	4.20E-11
1,2,3,4,7,8,9-HpCDF	1	5.91E-03	8.29E-03	8.48E-03	1.02E-09	7.62E-12
Other HpCDF	1	1.69E-02	2.37E-02	2.43E-02	2.92E-09	2.18E-11
OCDF	1	1.45E-02	2.04E-02	2.08E-02	2.51E-09	1.87E-11
TOTAL PCDF		5.68E-01	7.99E-01	8.16E-01	9.85E-08	7.33E-10
TOTAL PCDD/PCDF		1.13E+00	1.59E+00	1.62E+00	1.95E-07	1.46E-09

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-1

Congener	NY TEF	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	3.09E-03	4.31E-03	4.43E-03	5.32E-10	3.98E-12
Other TCDD	0.01	8.12E-04	1.13E-03	1.16E-03	1.40E-10	1.04E-12
1,2,3,7,8-PeCDD	1	8.45E-03	1.18E-02	1.21E-02	1.45E-09	1.09E-11
Other PeCDD	0.01	1.04E-03	1.45E-03	1.48E-03	1.78E-10	1.33E-12
1,2,3,4,7,8-HxCDD	0.03	1.79E-04	2.49E-04	2.56E-04	3.07E-11	2.30E-13
1,2,3,6,7,8-HxCDD	0.03	3.91E-04	5.46E-04	5.61E-04	6.73E-11	5.04E-13
1,2,3,7,8,9-HxCDD	0.03	2.91E-04	4.06E-04	4.17E-04	5.00E-11	3.75E-13
Other HxCDD	0.0003	4.49E-05	6.27E-05	6.44E-05	7.72E-12	5.78E-14
1,2,3,4,6,7,8-HpCDD	0.001	8.37E-05	1.17E-04	1.20E-04	1.44E-11	1.08E-13
Other HpCDD	0.00001	7.21E-07	1.01E-06	1.03E-06	1.24E-13	9.28E-16
OCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL PCDD		1.44E-02	2.01E-02	2.06E-02	2.47E-09	1.85E-11
2,3,7,8-TCDF	0.33	4.41E-03	6.15E-03	6.32E-03	7.58E-10	5.68E-12
Other TCDF	0.003	8.79E-04	1.23E-03	1.26E-03	1.51E-10	1.13E-12
1,2,3,7,8-PeCDF	0.33	8.49E-03	1.18E-02	1.22E-02	1.46E-09	1.09E-11
2,3,4,7,8-PeCDF	0.33	7.60E-03	1.06E-02	1.09E-02	1.31E-09	9.79E-12
Other PeCDF	0.003	7.39E-04	1.03E-03	1.06E-03	1.27E-10	9.51E-13
1,2,3,4,7,8-HxCDF	0.01	2.66E-04	3.71E-04	3.81E-04	4.57E-11	3.42E-13
1,2,3,6,7,8-HxCDF	0.01	2.95E-04	4.12E-04	4.23E-04	5.07E-11	3.80E-13
2,3,4,6,7,8-HxCDF	0.01	2.17E-04	3.03E-04	3.11E-04	3.74E-11	2.80E-13
1,2,3,7,8,9-HxCDF	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	0.0001	1.34E-05	1.87E-05	1.92E-05	2.31E-12	1.73E-14
1,2,3,4,6,7,8-HpCDF	0.001	5.96E-05	8.31E-05	8.54E-05	1.02E-11	7.67E-14
1,2,3,4,7,8,9-HpCDF	0.001	1.14E-05	1.59E-05	1.63E-05	1.96E-12	1.47E-14
Other HpCDF	0.00001	2.89E-07	4.03E-07	4.14E-07	4.97E-14	3.72E-16
OCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL PCDF		2.30E-02	3.21E-02	3.29E-02	3.95E-09	2.96E-11
TOTAL PCDD/PCDF		3.74E-02	5.21E-02	5.35E-02	6.42E-09	4.81E-11

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-2

Congener	NY TEF	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	7.67E-04	1.07E-03	1.10E-03	1.30E-10	9.87E-13
Other TCDD	0.01	7.36E-04	1.03E-03	1.05E-03	1.25E-10	9.48E-13
1,2,3,7,8-PeCDD	1	2.99E-03	4.17E-03	4.28E-03	5.08E-10	3.84E-12
Other PeCDD	0.01	1.00E-03	1.40E-03	1.43E-03	1.70E-10	1.29E-12
1,2,3,4,7,8-HxCDD	0.03	9.56E-05	1.33E-04	1.37E-04	1.63E-11	1.23E-13
1,2,3,6,7,8-HxCDD	0.03	2.74E-04	3.82E-04	3.93E-04	4.66E-11	3.53E-13
1,2,3,7,8,9-HxCDD	0.03	1.52E-04	2.12E-04	2.17E-04	2.58E-11	1.95E-13
Other HxCDD	0.0003	4.62E-05	6.45E-05	6.62E-05	7.86E-12	5.95E-14
1,2,3,4,6,7,8-HpCDD	0.001	5.89E-05	8.21E-05	8.43E-05	1.00E-11	7.58E-14
Other HpCDD	0.00001	5.69E-07	7.93E-07	8.15E-07	9.67E-14	7.32E-16
OCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL PCDD		6.12E-03	8.53E-03	8.77E-03	1.04E-09	7.87E-12
2,3,7,8-TCDF	0.33	1.44E-03	2.01E-03	2.06E-03	2.45E-10	1.85E-12
Other TCDF	0.003	3.94E-04	5.50E-04	5.65E-04	6.70E-11	5.08E-13
1,2,3,7,8-PeCDF	0.33	2.40E-03	3.35E-03	3.44E-03	4.08E-10	3.09E-12
2,3,4,7,8-PeCDF	0.33	2.83E-03	3.95E-03	4.06E-03	4.82E-10	3.65E-12
Other PeCDF	0.003	3.04E-04	4.24E-04	4.35E-04	5.17E-11	3.91E-13
1,2,3,4,7,8-HxCDF	0.01	8.27E-05	1.15E-04	1.19E-04	1.41E-11	1.06E-13
1,2,3,6,7,8-HxCDF	0.01	8.70E-05	1.21E-04	1.25E-04	1.48E-11	1.12E-13
2,3,4,6,7,8-HxCDF	0.01	9.04E-05	1.26E-04	1.30E-04	1.54E-11	1.16E-13
1,2,3,7,8,9-HxCDF	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	0.0001	5.35E-06	7.47E-06	7.67E-06	9.10E-13	6.89E-15
1,2,3,4,6,7,8-HpCDF	0.001	2.17E-05	3.02E-05	3.11E-05	3.69E-12	2.79E-14
1,2,3,4,7,8,9-HpCDF	0.001	4.05E-06	5.65E-06	5.80E-06	6.88E-13	5.21E-15
Other HpCDF	0.00001	1.33E-07	1.86E-07	1.91E-07	2.26E-14	1.72E-16
OCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL PCDF		7.66E-03	1.07E-02	1.10E-02	1.30E-09	9.86E-12
TOTAL PCDD/PCDF		1.38E-02	1.92E-02	1.97E-02	2.34E-09	1.77E-11

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-3

Congener	NY TEF	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	8.53E-04	1.23E-03	1.24E-03	1.53E-10	1.11E-12
Other TCDD	0.01	6.78E-04	9.81E-04	9.82E-04	1.22E-10	8.83E-13
1,2,3,7,8-PeCDD	1	2.82E-03	4.07E-03	4.08E-03	5.06E-10	3.66E-12
Other PeCDD	0.01	9.07E-04	1.31E-03	1.31E-03	1.63E-10	1.18E-12
1,2,3,4,7,8-HxCDD	0.03	8.26E-05	1.19E-04	1.20E-04	1.48E-11	1.07E-13
1,2,3,6,7,8-HxCDD	0.03	2.16E-04	3.13E-04	3.13E-04	3.89E-11	2.81E-13
1,2,3,7,8,9-HxCDD	0.03	1.06E-04	1.54E-04	1.54E-04	1.91E-11	1.38E-13
Other HxCDD	0.0003	3.78E-05	5.46E-05	5.47E-05	6.79E-12	4.91E-14
1,2,3,4,6,7,8-HpCDD	0.001	4.28E-05	6.19E-05	6.20E-05	7.69E-12	5.57E-14
Other HpCDD	0.00001	4.53E-07	6.55E-07	6.56E-07	8.15E-14	5.90E-16
OCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL PCDD		5.74E-03	8.30E-03	8.31E-03	1.03E-09	7.47E-12
2,3,7,8-TCDF	0.33	1.51E-03	2.19E-03	2.19E-03	2.72E-10	1.97E-12
Other TCDF	0.003	4.37E-04	6.32E-04	6.33E-04	7.86E-11	5.69E-13
1,2,3,7,8-PeCDF	0.33	2.76E-03	3.99E-03	4.00E-03	4.96E-10	3.59E-12
2,3,4,7,8-PeCDF	0.33	2.68E-03	3.88E-03	3.89E-03	4.83E-10	3.49E-12
Other PeCDF	0.003	3.32E-04	4.80E-04	4.81E-04	5.97E-11	4.32E-13
1,2,3,4,7,8-HxCDF	0.01	6.33E-05	9.16E-05	9.17E-05	1.14E-11	8.24E-14
1,2,3,6,7,8-HxCDF	0.01	8.39E-05	1.21E-04	1.21E-04	1.51E-11	1.09E-13
2,3,4,6,7,8-HxCDF	0.01	8.14E-05	1.18E-04	1.18E-04	1.46E-11	1.06E-13
1,2,3,7,8,9-HxCDF	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	0.0001	4.89E-06	7.07E-06	7.08E-06	8.80E-13	6.37E-15
1,2,3,4,6,7,8-HpCDF	0.001	1.65E-05	2.39E-05	2.39E-05	2.97E-12	2.15E-14
1,2,3,4,7,8,9-HpCDF	0.001	2.28E-06	3.30E-06	3.30E-06	4.10E-13	2.97E-15
Other HpCDF	0.00001	8.53E-08	1.23E-07	1.24E-07	1.53E-14	1.11E-16
OCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL PCDF		7.98E-03	1.15E-02	1.16E-02	1.43E-09	1.04E-11
TOTAL PCDD/PCDF		1.37E-02	1.98E-02	1.99E-02	2.47E-09	1.78E-11

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Average Concentration and Emission Rate Summary

<u>Congener</u>	<u>NY TEF</u>	<u>Concentration</u>			<u>Emission Rate</u>	
		<u>ng/DSCM</u>	<u>ng@12%</u>	<u>ng@7%</u>	<u>lb/hr</u>	<u>lb/MMBtu</u>
2,3,7,8-TCDD	1	1.57E-03	2.21E-03	2.25E-03	2.72E-10	2.03E-12
Other TCDD	0.01	7.42E-04	1.05E-03	1.07E-03	1.29E-10	9.58E-13
1,2,3,7,8-PeCDD	1	4.75E-03	6.68E-03	6.82E-03	8.22E-10	6.13E-12
Other PeCDD	0.01	9.81E-04	1.38E-03	1.41E-03	1.70E-10	1.27E-12
1,2,3,4,7,8-HxCDD	0.03	1.19E-04	1.67E-04	1.71E-04	2.06E-11	1.54E-13
1,2,3,6,7,8-HxCDD	0.03	2.94E-04	4.14E-04	4.22E-04	5.09E-11	3.79E-13
1,2,3,7,8,9-HxCDD	0.03	1.83E-04	2.57E-04	2.63E-04	3.16E-11	2.36E-13
Other HxCDD	0.0003	4.30E-05	6.06E-05	6.18E-05	7.46E-12	5.55E-14
1,2,3,4,6,7,8-HpCDD	0.001	6.18E-05	8.69E-05	8.87E-05	1.07E-11	7.97E-14
Other HpCDD	0.00001	5.81E-07	8.18E-07	8.35E-07	1.01E-13	7.50E-16
OCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL PCDD		8.75E-03	1.23E-02	1.26E-02	1.51E-09	1.13E-11
2,3,7,8-TCDF	0.33	2.45E-03	3.45E-03	3.53E-03	4.25E-10	3.17E-12
Other TCDF	0.003	5.70E-04	8.03E-04	8.19E-04	9.89E-11	7.36E-13
1,2,3,7,8-PeCDF	0.33	4.55E-03	6.39E-03	6.53E-03	7.88E-10	5.87E-12
2,3,4,7,8-PeCDF	0.33	4.37E-03	6.15E-03	6.28E-03	7.57E-10	5.64E-12
Other PeCDF	0.003	4.58E-04	6.45E-04	6.58E-04	7.95E-11	5.92E-13
1,2,3,4,7,8-HxCDF	0.01	1.37E-04	1.93E-04	1.97E-04	2.37E-11	1.77E-13
1,2,3,6,7,8-HxCDF	0.01	1.55E-04	2.18E-04	2.23E-04	2.69E-11	2.00E-13
2,3,4,6,7,8-HxCDF	0.01	1.30E-04	1.82E-04	1.86E-04	2.25E-11	1.67E-13
1,2,3,7,8,9-HxCDF	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	0.0001	7.89E-06	1.11E-05	1.13E-05	1.37E-12	1.02E-14
1,2,3,4,6,7,8-HpCDF	0.001	3.26E-05	4.58E-05	4.68E-05	5.63E-12	4.20E-14
1,2,3,4,7,8,9-HpCDF	0.001	5.91E-06	8.29E-06	8.48E-06	1.02E-12	7.62E-15
Other HpCDF	0.00001	1.69E-07	2.37E-07	2.43E-07	2.92E-14	2.18E-16
OCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL PCDF		1.29E-02	1.81E-02	1.85E-02	2.23E-09	1.66E-11
TOTAL PCDD/PCDF		2.16E-02	3.04E-02	3.11E-02	3.74E-09	2.79E-11

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-1

Congener	1989 ITEF	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	3.09E-03	4.31E-03	4.43E-03	5.32E-10	3.98E-12
Other TCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.5	4.23E-03	5.90E-03	6.06E-03	7.27E-10	5.44E-12
Other PeCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.1	5.96E-04	8.31E-04	8.54E-04	1.02E-10	7.67E-13
1,2,3,6,7,8-HxCDD	0.1	1.30E-03	1.82E-03	1.87E-03	2.24E-10	1.68E-12
1,2,3,7,8,9-HxCDD	0.1	9.70E-04	1.35E-03	1.39E-03	1.67E-10	1.25E-12
Other HxCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.01	8.37E-04	1.17E-03	1.20E-03	1.44E-10	1.08E-12
Other HpCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.001	1.38E-04	1.92E-04	1.97E-04	2.37E-11	1.77E-13
TOTAL PCDD		1.12E-02	1.56E-02	1.60E-02	1.92E-09	1.44E-11
2,3,7,8-TCDF	0.1	1.34E-03	1.86E-03	1.91E-03	2.30E-10	1.72E-12
Other TCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.05	1.29E-03	1.80E-03	1.84E-03	2.21E-10	1.66E-12
2,3,4,7,8-PeCDF	0.5	1.15E-02	1.61E-02	1.65E-02	1.98E-09	1.48E-11
Other PeCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.1	2.66E-03	3.71E-03	3.81E-03	4.57E-10	3.42E-12
1,2,3,6,7,8-HxCDF	0.1	2.95E-03	4.12E-03	4.23E-03	5.07E-10	3.80E-12
2,3,4,6,7,8-HxCDF	0.1	2.17E-03	3.03E-03	3.11E-03	3.74E-10	2.80E-12
1,2,3,7,8,9-HxCDF	0.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.01	5.96E-04	8.31E-04	8.54E-04	1.02E-10	7.67E-13
1,2,3,4,7,8,9-HpCDF	0.01	1.14E-04	1.59E-04	1.63E-04	1.96E-11	1.47E-13
Other HpCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.001	2.40E-05	3.35E-05	3.44E-05	4.13E-12	3.09E-14
TOTAL PCDF		2.27E-02	3.16E-02	3.25E-02	3.90E-09	2.92E-11
TOTAL PCDD/PCDF		3.38E-02	4.72E-02	4.85E-02	5.82E-09	4.35E-11

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-2

Congener	1989 ITEF	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	7.67E-04	1.07E-03	1.10E-03	1.30E-10	9.87E-13
Other TCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.5	1.49E-03	2.08E-03	2.14E-03	2.54E-10	1.92E-12
Other PeCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.1	3.19E-04	4.45E-04	4.57E-04	5.42E-11	4.10E-13
1,2,3,6,7,8-HxCDD	0.1	9.13E-04	1.27E-03	1.31E-03	1.55E-10	1.18E-12
1,2,3,7,8,9-HxCDD	0.1	5.05E-04	7.05E-04	7.24E-04	8.59E-11	6.51E-13
Other HxCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.01	5.89E-04	8.21E-04	8.43E-04	1.00E-10	7.58E-13
Other HpCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.001	8.96E-05	1.25E-04	1.28E-04	1.52E-11	1.15E-13
TOTAL PCDD		4.68E-03	6.52E-03	6.70E-03	7.95E-10	6.02E-12
2,3,7,8-TCDF	0.1	4.36E-04	6.09E-04	6.25E-04	7.42E-11	5.62E-13
Other TCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.05	3.63E-04	5.07E-04	5.21E-04	6.17E-11	4.68E-13
2,3,4,7,8-PeCDF	0.5	4.29E-03	5.99E-03	6.15E-03	7.30E-10	5.53E-12
Other PeCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.1	8.27E-04	1.15E-03	1.19E-03	1.41E-10	1.06E-12
1,2,3,6,7,8-HxCDF	0.1	8.70E-04	1.21E-03	1.25E-03	1.48E-10	1.12E-12
2,3,4,6,7,8-HxCDF	0.1	9.04E-04	1.26E-03	1.30E-03	1.54E-10	1.16E-12
1,2,3,7,8,9-HxCDF	0.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.01	2.17E-04	3.02E-04	3.11E-04	3.69E-11	2.79E-13
1,2,3,4,7,8,9-HpCDF	0.01	4.05E-05	5.65E-05	5.80E-05	6.88E-12	5.21E-14
Other HpCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.001	1.31E-05	1.83E-05	1.88E-05	2.23E-12	1.69E-14
TOTAL PCDF		7.96E-03	1.11E-02	1.14E-02	1.35E-09	1.03E-11
TOTAL PCDD/PCDF		1.26E-02	1.76E-02	1.81E-02	2.15E-09	1.63E-11

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-3

Congener	1989 ITEF	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	8.53E-04	1.23E-03	1.24E-03	1.53E-10	1.11E-12
Other TCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.5	1.41E-03	2.04E-03	2.04E-03	2.53E-10	1.83E-12
Other PeCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.1	2.75E-04	3.98E-04	3.99E-04	4.95E-11	3.58E-13
1,2,3,6,7,8-HxCDD	0.1	7.21E-04	1.04E-03	1.04E-03	1.30E-10	9.38E-13
1,2,3,7,8,9-HxCDD	0.1	3.55E-04	5.13E-04	5.14E-04	6.38E-11	4.61E-13
Other HxCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.01	4.28E-04	6.19E-04	6.20E-04	7.69E-11	5.57E-13
Other HpCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.001	6.59E-05	9.52E-05	9.54E-05	1.18E-11	8.57E-14
TOTAL PCDD		4.11E-03	5.94E-03	5.94E-03	7.38E-10	5.34E-12
2,3,7,8-TCDF	0.1	4.59E-04	6.63E-04	6.64E-04	8.25E-11	5.97E-13
Other TCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.05	4.18E-04	6.04E-04	6.05E-04	7.51E-11	5.44E-13
2,3,4,7,8-PeCDF	0.5	4.07E-03	5.88E-03	5.89E-03	7.31E-10	5.29E-12
Other PeCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.1	6.33E-04	9.16E-04	9.17E-04	1.14E-10	8.24E-13
1,2,3,6,7,8-HxCDF	0.1	8.39E-04	1.21E-03	1.21E-03	1.51E-10	1.09E-12
2,3,4,6,7,8-HxCDF	0.1	8.14E-04	1.18E-03	1.18E-03	1.46E-10	1.06E-12
1,2,3,7,8,9-HxCDF	0.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.01	1.65E-04	2.39E-04	2.39E-04	2.97E-11	2.15E-13
1,2,3,4,7,8,9-HpCDF	0.01	2.28E-05	3.30E-05	3.30E-05	4.10E-12	2.97E-14
Other HpCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.001	6.45E-06	9.32E-06	9.33E-06	1.16E-12	8.39E-15
TOTAL PCDF		7.43E-03	1.07E-02	1.08E-02	1.33E-09	9.66E-12
TOTAL PCDD/PCDF		1.15E-02	1.67E-02	1.67E-02	2.07E-09	1.50E-11

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

Unit 3 FF Outlet
Average Concentration and Emission Rate Summary

Congener	1989 ITEF	Concentration			Emission Rate	
		ng/DSCM	ng@12%	ng@7%	lb/hr	lb/MMBtu
2,3,7,8-TCDD	1	1.57E-03	2.21E-03	2.25E-03	2.72E-10	2.03E-12
Other TCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDD	0.5	2.38E-03	3.34E-03	3.41E-03	4.11E-10	3.07E-12
Other PeCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDD	0.1	3.97E-04	5.58E-04	5.70E-04	6.87E-11	5.12E-13
1,2,3,6,7,8-HxCDD	0.1	9.80E-04	1.38E-03	1.41E-03	1.70E-10	1.26E-12
1,2,3,7,8,9-HxCDD	0.1	6.10E-04	8.57E-04	8.76E-04	1.05E-10	7.87E-13
Other HxCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDD	0.01	6.18E-04	8.69E-04	8.87E-04	1.07E-10	7.97E-13
Other HpCDD	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDD	0.001	9.77E-05	1.37E-04	1.40E-04	1.69E-11	1.26E-13
TOTAL PCDD		6.65E-03	9.35E-03	9.55E-03	1.15E-09	8.58E-12
2,3,7,8-TCDF	0.1	7.44E-04	1.05E-03	1.07E-03	1.29E-10	9.60E-13
Other TCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,7,8-PeCDF	0.05	6.89E-04	9.69E-04	9.90E-04	1.19E-10	8.89E-13
2,3,4,7,8-PeCDF	0.5	6.63E-03	9.31E-03	9.52E-03	1.15E-09	8.55E-12
Other PeCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,7,8-HxCDF	0.1	1.37E-03	1.93E-03	1.97E-03	2.37E-10	1.77E-12
1,2,3,6,7,8-HxCDF	0.1	1.55E-03	2.18E-03	2.23E-03	2.69E-10	2.00E-12
2,3,4,6,7,8-HxCDF	0.1	1.30E-03	1.82E-03	1.86E-03	2.25E-10	1.67E-12
1,2,3,7,8,9-HxCDF	0.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other HxCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3,4,6,7,8-HpCDF	0.01	3.26E-04	4.58E-04	4.68E-04	5.63E-11	4.20E-13
1,2,3,4,7,8,9-HpCDF	0.01	5.91E-05	8.29E-05	8.48E-05	1.02E-11	7.62E-14
Other HpCDF	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OCDF	0.001	1.45E-05	2.04E-05	2.08E-05	2.51E-12	1.87E-14
TOTAL PCDF		1.27E-02	1.78E-02	1.82E-02	2.19E-09	1.64E-11
TOTAL PCDD/PCDF		1.93E-02	2.72E-02	2.78E-02	3.35E-09	2.49E-11

* In accordance with EPA Method 23, Section 9.9, results below the minimum detection limit were treated as zero when averaging or totaling the results. 68oF and 29.92 inches Hg

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

23

Client Name	Covanta Energy Group, Inc.	Operator	CMW
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 3 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number		3-O-M23-1	3-O-M23-2	
Run Date		08/27/13	08/27/13	
Run Start Time	hh:mm	830	1317	
Run Stop Time	hh:mm	1252	1721	1224

Sampling Parameters

Meter Calibration Factor	Y	1.0077	1.0077	1.0077	
Y _{QA} Calculated by Test Run	Y _{QA}	1.0151	0.9904	1.0153	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-15.00	-15.00	-15.00	-15.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.7	29.7	29.7	29.7
Actual Nozzle Diameter	in	0.212	0.210	0.212	
Carbon Dioxide Percentage	% CO ₂	8.6	8.6	8.3	8.5
Oxygen Percentage	% O ₂	11.2	11.2	11.3	11.2
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.4	80.3
Total Water Volume Collected	mL	626.4	623.8	527.7	592.6
Sample Volume	ft ³	126.550	127.034	130.384	127.989
Average Meter Temperature	°F	78	86	90	85
Average Stack Temperature	°F	293	293	294	294
Average Delta H	in H ₂ O	0.85	0.80	0.88	0.84
Total Sampling Time	min	240	240	240	240

Air Flow Parameters

Volume of Water vapor @ STP	SCF	29.485	29.362	24.839	27.895
Volume Metered @ STP	DSCF	124.465	122.973	125.423	124.287
Absolute Stack/Duct Pressure	in Hg	28.6	28.6	28.6	28.6
Absolute Meter Pressure	in Hg	29.8	29.8	29.8	29.8
Calculated Stack Moisture	% H ₂ O	19.2	19.3	16.5	18.3
Saturated Stack Moisture	% H ₂ O	100.0	100.0	100.0	100.0
Reported Stack Moisture Content	% H ₂ O	19.2	19.3	16.5	18.3
Dry Mole Fraction	decimal	0.808	0.807	0.835	0.817
Avg Square of Differential Pressure	in H ₂ O	0.929	0.920	0.946	0.932
Avg Square of Diff. Pres., Squared	in H ₂ O	0.863	0.846	0.895	0.868
Dry Gas Molecular Weight	lb/lb-mole	29.82	29.82	29.78	29.81
Wet Stack Gas Molecular Weight	lb/lb-mole	27.56	27.54	27.83	27.65
Average Stack Gas Velocity	ft/sec	65.21	64.62	66.13	65.32
Percent of Isokinetic Rate	% ISO	99.8	101.7	96.2	99.2

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	84,706	83,931	85,898	84,845
Dry Standard Stack Flow/Minute	DSCFM	45,897	45,380	47,983	46,420
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	32,029	31,668	33,139	32,279

Concentration and Emission Rate Data Summary						
Acenaphthene	ng	70.70	41.80	57.50		56.67
Concentration, ug/Nm3	ug/Nm3	2.01E-02	1.20E-02	1.62E-02		1.61E-02
Concen., ug/Nm3 @ 12% CO2	ug@12%	2.80E-02	1.67E-02	2.34E-02		2.27E-02
Concen., ug/Nm3 @ 7% O2	ug@7%	2.87E-02	1.72E-02	2.34E-02		2.31E-02
Emission Rate, lb/hr	lb/hr	3.45E-06	2.04E-06	2.91E-06		2.80E-06
Emission Rate, grams/second	g/s	4.35E-07	2.57E-07	3.67E-07		3.53E-07
Acenaphthylene	ng	80.20	50.00	44.20		58.13
Concentration, ug/Nm3	ug/Nm3	2.28E-02	1.44E-02	1.24E-02		1.65E-02
Concen., ug/Nm3 @ 12% CO2	ug@12%	3.17E-02	2.00E-02	1.80E-02		2.33E-02
Concen., ug/Nm3 @ 7% O2	ug@7%	3.26E-02	2.06E-02	1.80E-02		2.37E-02
Emission Rate, lb/hr	lb/hr	3.91E-06	2.44E-06	2.24E-06		2.86E-06
Emission Rate, grams/second	g/s	4.93E-07	3.08E-07	2.82E-07		3.61E-07
Anthracene	ng	57.00	40.60	39.90		45.83
Concentration, ug/Nm3	ug/Nm3	1.62E-02	1.17E-02	1.12E-02		1.30E-02
Concen., ug/Nm3 @ 12% CO2	ug@12%	2.26E-02	1.63E-02	1.62E-02		1.84E-02
Concen., ug/Nm3 @ 7% O2	ug@7%	2.32E-02	1.67E-02	1.63E-02		1.87E-02
Emission Rate, lb/hr	lb/hr	2.78E-06	1.98E-06	2.02E-06		2.26E-06
Emission Rate, grams/second	g/s	3.50E-07	2.50E-07	2.54E-07		2.85E-07
Benzo[a]anthracene	ng	3.24	3.93	3.81		3.66
Concentration, ug/Nm3	ug/Nm3	9.19E-04	1.13E-03	1.07E-03		1.04E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	1.28E-03	1.57E-03	1.55E-03		1.47E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	1.32E-03	1.62E-03	1.55E-03		1.50E-03
Emission Rate, lb/hr	lb/hr	1.58E-07	1.92E-07	1.93E-07		1.81E-07
Emission Rate, grams/second	g/s	1.99E-08	2.42E-08	2.43E-08		2.28E-08
Benzo[a]pyrene	ng	3.31	3.57	4.02		3.63
Concentration, ug/Nm3	ug/Nm3	9.39E-04	1.03E-03	1.13E-03		1.03E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	1.31E-03	1.43E-03	1.64E-03		1.46E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	1.35E-03	1.47E-03	1.64E-03		1.48E-03
Emission Rate, lb/hr	lb/hr	1.61E-07	1.74E-07	2.03E-07		1.80E-07
Emission Rate, grams/second	g/s	2.03E-08	2.20E-08	2.56E-08		2.26E-08
Benzo[e]pyrene	ng	10.80	23.90	18.40		17.70
Concentration, ug/Nm3	ug/Nm3	3.06E-03	6.86E-03	5.18E-03		5.04E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	4.28E-03	9.58E-03	7.49E-03		7.11E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	4.39E-03	9.83E-03	7.50E-03		7.24E-03
Emission Rate, lb/hr	lb/hr	5.27E-07	1.17E-06	9.31E-07		8.75E-07
Emission Rate, grams/second	g/s	6.64E-08	1.47E-07	1.17E-07		1.10E-07
Benzo[b]fluoranthene	ng	9.84	11.90	9.67		10.47
Concentration, ug/Nm3	ug/Nm3	2.79E-03	3.42E-03	2.72E-03		2.98E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	3.90E-03	4.77E-03	3.94E-03		4.20E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	4.00E-03	4.90E-03	3.94E-03		4.28E-03
Emission Rate, lb/hr	lb/hr	4.80E-07	5.81E-07	4.89E-07		5.17E-07
Emission Rate, grams/second	g/s	6.05E-08	7.32E-08	6.17E-08		6.51E-08

Benzo[g,h,i]perylene	ng	24.10	129.00	35.90		63.00
Concentration, ug/Nm3	ug/Nm3	6.84E-03	3.70E-02	1.01E-02		1.80E-02
Concen., ug/Nm3 @ 12% CO2	ug@12%	9.54E-03	5.17E-02	1.46E-02		2.53E-02
Concen., ug/Nm3 @ 7% O2	ug@7%	9.80E-03	5.31E-02	1.46E-02		2.58E-02
Emission Rate, lb/hr	lb/hr	1.18E-06	6.30E-06	1.82E-06		3.10E-06
Emission Rate, grams/second	g/s	1.48E-07	7.93E-07	2.29E-07		3.90E-07
Benzo[k]fluoranthene	ng	4.00	4.09	3.78		3.96
Concentration, ug/Nm3	ug/Nm3	1.13E-03	1.17E-03	1.06E-03		1.12E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	1.58E-03	1.64E-03	1.54E-03		1.59E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	1.63E-03	1.68E-03	1.54E-03		1.62E-03
Emission Rate, lb/hr	lb/hr	1.95E-07	2.00E-07	1.91E-07		1.95E-07
Emission Rate, grams/second	g/s	2.46E-08	2.52E-08	2.41E-08		2.46E-08
Chrysene	ng	20.20	12.60	13.80		15.53
Concentration, ug/Nm3	ug/Nm3	5.73E-03	3.62E-03	3.89E-03		4.41E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	8.00E-03	5.05E-03	5.62E-03		6.22E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	8.21E-03	5.18E-03	5.63E-03		6.34E-03
Emission Rate, lb/hr	lb/hr	9.85E-07	6.15E-07	6.98E-07		7.66E-07
Emission Rate, grams/second	g/s	1.24E-07	7.75E-08	8.80E-08		9.65E-08
Dibenzo[a,h]anthracene	ng	0.67	0.52	< 0.40	<	0.53
Concentration, ug/Nm3	ug/Nm3	1.89E-04	1.48E-04	< 1.13E-04	<	1.50E-04
Concen., ug/Nm3 @ 12% CO2	ug@12%	2.64E-04	2.07E-04	< 1.64E-04	<	2.12E-04
Concen., ug/Nm3 @ 7% O2	ug@7%	2.71E-04	2.12E-04	< 1.64E-04	<	2.16E-04
Emission Rate, lb/hr	lb/hr	3.25E-08	2.52E-08	< 2.04E-08	<	2.60E-08
Emission Rate, grams/second	g/s	4.10E-09	3.17E-09	< 2.57E-09	<	3.28E-09
Fluoranthene	ng	204.00	163.00	214.00		193.67
Concentration, ug/Nm3	ug/Nm3	5.79E-02	4.68E-02	6.02E-02		5.50E-02
Concen., ug/Nm3 @ 12% CO2	ug@12%	8.08E-02	6.53E-02	8.71E-02		7.77E-02
Concen., ug/Nm3 @ 7% O2	ug@7%	8.29E-02	6.71E-02	8.72E-02		7.91E-02
Emission Rate, lb/hr	lb/hr	9.95E-06	7.96E-06	1.08E-05		9.58E-06
Emission Rate, grams/second	g/s	1.25E-06	1.00E-06	1.36E-06		1.21E-06
Fluorene	ng	333.00	125.00	157.00		205.00
Concentration, ug/Nm3	ug/Nm3	9.45E-02	3.59E-02	4.42E-02		5.82E-02
Concen., ug/Nm3 @ 12% CO2	ug@12%	1.32E-01	5.01E-02	6.39E-02		8.19E-02
Concen., ug/Nm3 @ 7% O2	ug@7%	1.35E-01	5.14E-02	6.40E-02		8.36E-02
Emission Rate, lb/hr	lb/hr	1.62E-05	6.10E-06	7.95E-06		1.01E-05
Emission Rate, grams/second	g/s	2.05E-06	7.69E-07	1.00E-06		1.27E-06
Indeno(1,2,3-c,d)pyrene	ng	6.27	21.50	7.10		11.62
Concentration, ug/Nm3	ug/Nm3	1.78E-03	6.17E-03	2.00E-03		3.32E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	2.48E-03	8.61E-03	2.89E-03		4.66E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	2.55E-03	8.85E-03	2.89E-03		4.76E-03
Emission Rate, lb/hr	lb/hr	3.06E-07	1.05E-06	3.59E-07		5.72E-07
Emission Rate, grams/second	g/s	3.85E-08	1.32E-07	4.53E-08		7.20E-08
2-Methylnaphthalene	ng	410.00	210.00	340.00		320.00
Concentration, ug/Nm3	ug/Nm3	1.16E-01	6.03E-02	9.57E-02		9.08E-02
Concen., ug/Nm3 @ 12% CO2	ug@12%	1.62E-01	8.41E-02	1.38E-01		1.28E-01
Concen., ug/Nm3 @ 7% O2	ug@7%	1.67E-01	8.64E-02	1.39E-01		1.31E-01
Emission Rate, lb/hr	lb/hr	2.00E-05	1.03E-05	1.72E-05		1.58E-05
Emission Rate, grams/second	g/s	2.52E-06	1.29E-06	2.17E-06		1.99E-06

Naphthalene, uncorrected	ng	2060.00	836.00	943.00		1279.67
Concentration, ug/Nm3	ug/Nm3	5.84E-01	2.40E-01	2.65E-01		3.63E-01
Concen., ug/Nm3 @ 12% CO2	ug@12%	8.15E-01	3.35E-01	3.84E-01		5.11E-01
Concen., ug/Nm3 @ 7% O2	ug@7%	8.37E-01	3.44E-01	3.84E-01		5.22E-01
Emission Rate, lb/hr	lb/hr	1.00E-04	4.08E-05	4.77E-05		6.30E-05
Emission Rate, grams/second	g/s	1.27E-05	5.14E-06	6.01E-06		7.94E-06

Naphthalene, corrected	ng	1403.00	179.00	286.00		622.67
Concentration, ug/Nm3	ug/Nm3	3.98E-01	5.14E-02	8.05E-02		1.77E-01
Concen., ug/Nm3 @ 12% CO2	ug@12%	5.55E-01	7.17E-02	1.16E-01		2.48E-01
Concen., ug/Nm3 @ 7% O2	ug@7%	5.70E-01	7.37E-02	1.17E-01		2.54E-01
Emission Rate, lb/hr	lb/hr	6.84E-05	8.74E-06	1.45E-05		3.05E-05
Emission Rate, grams/second	g/s	8.62E-06	1.10E-06	1.82E-06		3.85E-06

Perylene	ng	1.02	1.02	0.85		0.96
Concentration, ug/Nm3	ug/Nm3	2.89E-04	2.93E-04	2.40E-04		2.74E-04
Concen., ug/Nm3 @ 12% CO2	ug@12%	4.04E-04	4.09E-04	3.46E-04		3.86E-04
Concen., ug/Nm3 @ 7% O2	ug@7%	4.15E-04	4.20E-04	3.47E-04		3.94E-04
Emission Rate, lb/hr	lb/hr	4.98E-08	4.98E-08	4.31E-08		4.75E-08
Emission Rate, grams/second	g/s	6.27E-09	6.27E-09	5.43E-09		5.99E-09

Phenanthrene	ng	503.00	366.00	442.00		437.00
Concentration, ug/Nm3	ug/Nm3	1.43E-01	1.05E-01	1.24E-01		1.24E-01
Concen., ug/Nm3 @ 12% CO2	ug@12%	1.99E-01	1.47E-01	1.80E-01		1.75E-01
Concen., ug/Nm3 @ 7% O2	ug@7%	2.04E-01	1.51E-01	1.80E-01		1.78E-01
Emission Rate, lb/hr	lb/hr	2.45E-05	1.79E-05	2.24E-05		2.16E-05
Emission Rate, grams/second	g/s	3.09E-06	2.25E-06	2.82E-06		2.72E-06

Pyrene	ng	167.00	133.00	187.00		162.33
Concentration, ug/Nm3	ug/Nm3	4.74E-02	3.82E-02	5.26E-02		4.61E-02
Concen., ug/Nm3 @ 12% CO2	ug@12%	6.61E-02	5.33E-02	7.61E-02		6.52E-02
Concen., ug/Nm3 @ 7% O2	ug@7%	6.79E-02	5.47E-02	7.62E-02		6.63E-02
Emission Rate, lb/hr	lb/hr	8.15E-06	6.49E-06	9.46E-06		8.03E-06
Emission Rate, grams/second	g/s	1.03E-06	8.18E-07	1.19E-06		1.01E-06

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-1

Congener	Concentration			Emission Rate	
	ug/Nm3	ug@12%	ug@7%	lb/hr	grams/sec
Acenaphthene	2.01E-02	2.80E-02	2.87E-02	3.45E-06	4.35E-07
Acenaphthylene	2.28E-02	3.17E-02	3.26E-02	3.91E-06	4.93E-07
Anthracene	1.62E-02	2.26E-02	2.32E-02	2.78E-06	3.50E-07
Benzo[a]anthracene	9.19E-04	1.28E-03	1.32E-03	1.58E-07	1.99E-08
Benzo[a]pyrene	9.39E-04	1.31E-03	1.35E-03	1.61E-07	2.03E-08
Benzo[e]pyrene	3.06E-03	4.28E-03	4.39E-03	5.27E-07	6.64E-08
Benzo[b]fluoranthene	2.79E-03	3.90E-03	4.00E-03	4.80E-07	6.05E-08
Benzo[g,h,i]perylene	6.84E-03	9.54E-03	9.80E-03	1.18E-06	1.48E-07
Benzo[k]fluoranthene	1.13E-03	1.58E-03	1.63E-03	1.95E-07	2.46E-08
Chrysene	5.73E-03	8.00E-03	8.21E-03	9.85E-07	1.24E-07
Dibenzo[a,h]anthracene	1.89E-04	2.64E-04	2.71E-04	3.25E-08	4.10E-09
Fluoranthene	5.79E-02	8.08E-02	8.29E-02	9.95E-06	1.25E-06
Fluorene	9.45E-02	1.32E-01	1.35E-01	1.62E-05	2.05E-06
Indeno(1,2,3-c,d)pyrene	1.78E-03	2.48E-03	2.55E-03	3.06E-07	3.85E-08
2-Methylnaphthalene	1.16E-01	1.62E-01	1.67E-01	2.00E-05	2.52E-06
Naphthalene, uncorrected	5.84E-01	8.15E-01	8.37E-01	1.00E-04	1.27E-05
Perylene	2.89E-04	4.04E-04	4.15E-04	4.98E-08	6.27E-09
Phenanthrene	1.43E-01	1.99E-01	2.04E-01	2.45E-05	3.09E-06
Pyrene	4.74E-02	6.61E-02	6.79E-02	8.15E-06	1.03E-06
Total PAHs					
Corrected for artifacts (Acenaphthene, Naphthalene 2-Methylnaphthalene)	4.05E-01	5.65E-01	5.80E-01	6.96E-05	8.77E-06
Uncorrected PAHs	1.13E+00	1.57E+00	1.61E+00	1.94E-04	2.44E-05

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-2

<u>Congener</u>	<u>Concentration</u>			<u>Emission Rate</u>	
	<u>ug/Nm3</u>	<u>ug@12%</u>	<u>ug@7%</u>	<u>lb/hr</u>	<u>grams/sec</u>
Acenaphthene	1.20E-02	1.67E-02	1.72E-02	2.04E-06	2.57E-07
Acenaphthylene	1.44E-02	2.00E-02	2.06E-02	2.44E-06	3.08E-07
Anthracene	1.17E-02	1.63E-02	1.67E-02	1.98E-06	2.50E-07
Benzo[a]anthracene	1.13E-03	1.57E-03	1.62E-03	1.92E-07	2.42E-08
Benzo[a]pyrene	1.03E-03	1.43E-03	1.47E-03	1.74E-07	2.20E-08
Benzo[e]pyrene	6.86E-03	9.58E-03	9.83E-03	1.17E-06	1.47E-07
Benzo[b]fluoranthene	3.42E-03	4.77E-03	4.90E-03	5.81E-07	7.32E-08
Benzo[g,h,i]perylene	3.70E-02	5.17E-02	5.31E-02	6.30E-06	7.93E-07
Benzo[k]fluoranthene	1.17E-03	1.64E-03	1.68E-03	2.00E-07	2.52E-08
Chrysene	3.62E-03	5.05E-03	5.18E-03	6.15E-07	7.75E-08
Dibenzo[a,h]anthracene	1.48E-04	2.07E-04	2.12E-04	2.52E-08	3.17E-09
Fluoranthene	4.68E-02	6.53E-02	6.71E-02	7.96E-06	1.00E-06
Fluorene	3.59E-02	5.01E-02	5.14E-02	6.10E-06	7.69E-07
Indeno(1,2,3-c,d)pyrene	6.17E-03	8.61E-03	8.85E-03	1.05E-06	1.32E-07
2-Methylnaphthalene	6.03E-02	8.41E-02	8.64E-02	1.03E-05	1.29E-06
Naphthalene, uncorrected	2.40E-01	3.35E-01	3.44E-01	4.08E-05	5.14E-06
Perylene	2.93E-04	4.09E-04	4.20E-04	4.98E-08	6.27E-09
Phenanthrene	1.05E-01	1.47E-01	1.51E-01	1.79E-05	2.25E-06
Pyrene	3.82E-02	5.33E-02	5.47E-02	6.49E-06	8.18E-07
Total PAHs					
Corrected for artifacts (Acenaphthene, Naphthalene 2-Methylnaphthalene)	3.13E-01	4.37E-01	4.48E-01	5.32E-05	6.70E-06
Uncorrected PAHs	6.25E-01	8.72E-01	8.96E-01	1.06E-04	1.34E-05

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-3

Congener	Concentration			Emission Rate	
	ug/Nm3	ug@12%	ug@7%	lb/hr	grams/sec
Acenaphthene	1.62E-02	2.34E-02	2.34E-02	2.91E-06	3.67E-07
Acenaphthylene	1.24E-02	1.80E-02	1.80E-02	2.24E-06	2.82E-07
Anthracene	1.12E-02	1.62E-02	1.63E-02	2.02E-06	2.54E-07
Benzo[a]anthracene	1.07E-03	1.55E-03	1.55E-03	1.93E-07	2.43E-08
Benzo[a]pyrene	1.13E-03	1.64E-03	1.64E-03	2.03E-07	2.56E-08
Benzo[e]pyrene	5.18E-03	7.49E-03	7.50E-03	9.31E-07	1.17E-07
Benzo[b]fluoranthene	2.72E-03	3.94E-03	3.94E-03	4.89E-07	6.17E-08
Benzo[g,h,i]perylene	1.01E-02	1.46E-02	1.46E-02	1.82E-06	2.29E-07
Benzo[k]fluoranthene	1.06E-03	1.54E-03	1.54E-03	1.91E-07	2.41E-08
Chrysene	3.89E-03	5.62E-03	5.63E-03	6.98E-07	8.80E-08
Dibenzo[a,h]anthracene	< 1.13E-04	< 1.64E-04	< 1.64E-04	< 2.04E-08	< 2.57E-09
Fluoranthene	6.02E-02	8.71E-02	8.72E-02	1.08E-05	1.36E-06
Fluorene	4.42E-02	6.39E-02	6.40E-02	7.95E-06	1.00E-06
Indeno(1,2,3-c,d)pyrene	2.00E-03	2.89E-03	2.89E-03	3.59E-07	4.53E-08
2-Methylnaphthalene	9.57E-02	1.38E-01	1.39E-01	1.72E-05	2.17E-06
Naphthalene, uncorrected	2.65E-01	3.84E-01	3.84E-01	4.77E-05	6.01E-06
Perylene	2.40E-04	3.46E-04	3.47E-04	4.31E-08	5.43E-09
Phenanthrene	1.24E-01	1.80E-01	1.80E-01	2.24E-05	2.82E-06
Pyrene	5.26E-02	7.61E-02	7.62E-02	9.46E-06	1.19E-06
Total PAHs					
Corrected for artifacts (Acenaphthene, Naphthalene 2-Methylnaphthalene)	< 3.33E-01	< 4.81E-01	< 4.82E-01	< 5.98E-05	< 7.54E-06
Uncorrected PAHs	< 7.10E-01	< 1.03E+00	< 1.03E+00	< 1.28E-04	< 1.61E-05

Unit 3 FF Outlet
Average Concentration and Emission Rate Summary

Congener	Concentration			Emission Rate	
	ug/Nm3	ug@12%	ug@7%	lb/hr	grams/sec
Acenaphthene	1.61E-02	2.27E-02	2.31E-02	2.80E-06	3.53E-07
Acenaphthylene	1.65E-02	2.33E-02	2.37E-02	2.86E-06	3.61E-07
Anthracene	1.30E-02	1.84E-02	1.87E-02	2.26E-06	2.85E-07
Benzo[a]anthracene	1.04E-03	1.47E-03	1.50E-03	1.81E-07	2.28E-08
Benzo[a]pyrene	1.03E-03	1.46E-03	1.48E-03	1.80E-07	2.26E-08
Benzo[e]pyrene	5.04E-03	7.11E-03	7.24E-03	8.75E-07	1.10E-07
Benzo[b]fluoranthene	2.98E-03	4.20E-03	4.28E-03	5.17E-07	6.51E-08
Benzo[g,h,i]perylene	1.80E-02	2.53E-02	2.58E-02	3.10E-06	3.90E-07
Benzo[k]fluoranthene	1.12E-03	1.59E-03	1.62E-03	1.95E-07	2.46E-08
Chrysene	4.41E-03	6.22E-03	6.34E-03	7.66E-07	9.65E-08
Dibenzo[a,h]anthracene	< 1.50E-04	< 2.12E-04	< 2.16E-04	< 2.60E-08	< 3.28E-09
Fluoranthene	5.50E-02	7.77E-02	7.91E-02	9.58E-06	1.21E-06
Fluorene	5.82E-02	8.19E-02	8.36E-02	1.01E-05	1.27E-06
Indeno(1,2,3-c,d)pyrene	3.32E-03	4.66E-03	4.76E-03	5.72E-07	7.20E-08
2-Methylnaphthalene	9.08E-02	1.28E-01	1.31E-01	1.58E-05	1.99E-06
Naphthalene, uncorrected	3.63E-01	5.11E-01	5.22E-01	6.30E-05	7.94E-06
Perylene	2.74E-04	3.86E-04	3.94E-04	4.75E-08	5.99E-09
Phenanthrene	1.24E-01	1.75E-01	1.78E-01	2.16E-05	2.72E-06
Pyrene	4.61E-02	6.52E-02	6.63E-02	8.03E-06	1.01E-06
Total PAHs					
Corrected for artifacts (Acenaphthene, Naphthalene 2-Methylnaphthalene)	<	3.50E-01	< 4.94E-01	< 5.03E-01	< 6.09E-05 < 7.67E-06
Uncorrected PAHs	<	8.20E-01	< 1.16E+00	< 1.18E+00	< 1.42E-04 < 1.80E-05

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

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Client Name	Covanta Energy Group, Inc.	Operator	CMW
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 3 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number	3-O-M23-1	3-O-M23-2	3-O-M23-3	
Run Date	08/27/13	08/27/13	08/28/13	
Run Start Time	hh:mm	830	1317	
Run Stop Time	hh:mm	1252	1721	

Sampling Parameters

Meter Calibration Factor	Y	1.0077	1.0077	1.0077	
Y_{QA} Calculated by Test Run	Y _{QA}	1.0151	0.9904	1.0153	
Y_{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-15.00	-15.00	-15.00	-15.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.7	29.7	29.7	29.7
Actual Nozzle Diameter	in	0.212	0.210	0.212	
Carbon Dioxide Percentage	% CO ₂	8.6	8.6	8.3	8.5
Oxygen Percentage	% O ₂	11.2	11.2	11.3	11.2
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.4	80.3
Total Water Volume Collected	mL	626.4	623.8	527.7	592.6
Sample Volume	ft ³	126.550	127.034	130.384	127.989
Average Meter Temperature	°F	78	86	90	85
Average Stack Temperature	°F	293	293	294	294
Average Delta H	in H ₂ O	0.85	0.80	0.88	0.84
Total Sampling Time	min	240	240	240	240

Air Flow Parameters

Volume of Water vapor @ STP	SCF	29.485	29.362	24.839	27.895
Volume Metered @ STP	DSCF	124.465	122.973	125.423	124.287
Absolute Stack/Duct Pressure	in Hg	28.6	28.6	28.6	28.6
Absolute Meter Pressure	in Hg	29.8	29.8	29.8	29.8
Calculated Stack Moisture	% H ₂ O	19.2	19.3	16.5	18.3
Saturated Stack Moisture	% H ₂ O	100.0	100.0	100.0	100.0
Reported Stack Moisture Content	% H ₂ O	19.2	19.3	16.5	18.3
Dry Mole Fraction	decimal	0.808	0.807	0.835	0.817
Avg Square of Differential Pressure	in H ₂ O	0.929	0.920	0.946	0.932
Avg Square of Diff. Pres., Squared	in H ₂ O	0.863	0.846	0.895	0.868
Dry Gas Molecular Weight	lb/lb-mole	29.82	29.82	29.78	29.81
Wet Stack Gas Molecular Weight	lb/lb-mole	27.56	27.54	27.83	27.65
Average Stack Gas Velocity	ft/sec	65.21	64.62	66.13	65.32
Percent of Isokinetic Rate	% ISO	99.8	101.7	96.2	99.2

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	84,706	83,931	85,898	84,845
Dry Standard Stack Flow/Minute	DSCFM	45,897	45,380	47,983	46,420
Dry Standard Flow/Minute @ 7% O₂	DSCFM7	32,029	31,668	33,139	32,279

Concentration and Emission Rate Data Summary					
MonoPCBs	pg	5250.00	8300.00	3680.00	5743.33
Concentration, ug/Nm3	ug/Nm3	1.49E-03	2.38E-03	1.04E-03	1.64E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	2.08E-03	3.33E-03	1.50E-03	2.30E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	2.13E-03	3.42E-03	1.50E-03	2.35E-03
Emission Rate, lb/hr	lb/hr	2.56E-07	4.05E-07	1.86E-07	2.82E-07
Emission Rate, grams/second	g/s	3.23E-08	5.10E-08	2.35E-08	3.56E-08
DiPCBs	pg	6440.00	6680.00	10100.00	7740.00
Concentration, ug/Nm3	ug/Nm3	1.83E-03	1.92E-03	2.84E-03	2.20E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	2.55E-03	2.68E-03	4.11E-03	3.11E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	2.62E-03	2.75E-03	4.12E-03	3.16E-03
Emission Rate, lb/hr	lb/hr	3.14E-07	3.26E-07	5.11E-07	3.84E-07
Emission Rate, grams/second	g/s	3.96E-08	4.11E-08	6.44E-08	4.84E-08
TriPCBs	pg	19600.00	7090.00	24000.00	16896.67
Concentration, ug/Nm3	ug/Nm3	5.56E-03	2.04E-03	6.76E-03	4.78E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	7.76E-03	2.84E-03	9.77E-03	6.79E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	7.97E-03	2.92E-03	9.78E-03	6.89E-03
Emission Rate, lb/hr	lb/hr	9.56E-07	3.46E-07	1.21E-06	8.39E-07
Emission Rate, grams/second	g/s	1.20E-07	4.36E-08	1.53E-07	1.06E-07
TetraPCBs	pg	27200.00	6050.00	30000.00	21083.33
Concentration, ug/Nm3	ug/Nm3	7.72E-03	1.74E-03	8.45E-03	5.97E-03
Concen., ug/Nm3 @ 12% CO2	ug@12%	1.08E-02	2.42E-03	1.22E-02	8.47E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	1.11E-02	2.49E-03	1.22E-02	8.59E-03
Emission Rate, lb/hr	lb/hr	1.33E-06	2.95E-07	1.52E-06	1.05E-06
Emission Rate, grams/second	g/s	1.67E-07	3.72E-08	1.91E-07	1.32E-07
PentaPCBs	pg	3630.00	1750.00	4080.00	3153.33
Concentration, ug/Nm3	ug/Nm3	1.03E-03	5.02E-04	1.15E-03	8.94E-04
Concen., ug/Nm3 @ 12% CO2	ug@12%	1.44E-03	7.01E-04	1.66E-03	1.27E-03
Concen., ug/Nm3 @ 7% O2	ug@7%	1.48E-03	7.20E-04	1.66E-03	1.29E-03
Emission Rate, lb/hr	lb/hr	1.77E-07	8.54E-08	2.06E-07	1.56E-07
Emission Rate, grams/second	g/s	2.23E-08	1.08E-08	2.60E-08	1.97E-08
HexaPCBs	pg	1320.00	1080.00	1380.00	1260.00
Concentration, ug/Nm3	ug/Nm3	3.74E-04	3.10E-04	3.89E-04	3.58E-04
Concen., ug/Nm3 @ 12% CO2	ug@12%	5.23E-04	4.33E-04	5.62E-04	5.06E-04
Concen., ug/Nm3 @ 7% O2	ug@7%	5.37E-04	4.44E-04	5.63E-04	5.15E-04
Emission Rate, lb/hr	lb/hr	6.44E-08	5.27E-08	6.98E-08	6.23E-08
Emission Rate, grams/second	g/s	8.11E-09	6.64E-09	8.80E-09	7.85E-09
HeptaPCBs	pg	1340.00	1270.00	1270.00	1293.33
Concentration, ug/Nm3	ug/Nm3	3.80E-04	3.65E-04	3.58E-04	3.67E-04
Concen., ug/Nm3 @ 12% CO2	ug@12%	5.30E-04	5.09E-04	5.17E-04	5.19E-04
Concen., ug/Nm3 @ 7% O2	ug@7%	5.45E-04	5.23E-04	5.18E-04	5.28E-04
Emission Rate, lb/hr	lb/hr	6.54E-08	6.20E-08	6.43E-08	6.39E-08
Emission Rate, grams/second	g/s	8.24E-09	7.81E-09	8.10E-09	8.05E-09

OctaPCBs	pg	637.00	685.00	595.00		639.00
Concentration, ug/Nm3	ug/Nm3	1.81E-04	1.97E-04	1.68E-04		1.82E-04
Concen., ug/Nm3 @ 12% CO2	ug@12%	2.52E-04	2.74E-04	2.42E-04		2.56E-04
Concen., ug/Nm3 @ 7% O2	ug@7%	2.59E-04	2.82E-04	2.43E-04		2.61E-04
Emission Rate, lb/hr	lb/hr	3.11E-08	3.34E-08	3.01E-08		3.15E-08
Emission Rate, grams/second	g/s	3.91E-09	4.21E-09	3.79E-09		3.97E-09

NonaPCBs	pg	27.40	74.10	73.40		58.30
Concentration, ug/Nm3	ug/Nm3	7.77E-06	2.13E-05	2.07E-05		1.66E-05
Concen., ug/Nm3 @ 12% CO2	ug@12%	1.08E-05	2.97E-05	2.99E-05		2.35E-05
Concen., ug/Nm3 @ 7% O2	ug@7%	1.11E-05	3.05E-05	2.99E-05		2.38E-05
Emission Rate, lb/hr	lb/hr	1.34E-09	3.62E-09	3.71E-09		2.89E-09
Emission Rate, grams/second	g/s	1.68E-10	4.56E-10	4.68E-10		3.64E-10

DecaPCBs	pg	22.80	20.50	23.40		22.23
Concentration, ug/Nm3	ug/Nm3	6.47E-06	5.89E-06	6.59E-06		6.31E-06
Concen., ug/Nm3 @ 12% CO2	ug@12%	9.03E-06	8.21E-06	9.52E-06		8.92E-06
Concen., ug/Nm3 @ 7% O2	ug@7%	9.27E-06	8.43E-06	9.54E-06		9.08E-06
Emission Rate, lb/hr	lb/hr	1.11E-09	1.00E-09	1.18E-09		1.10E-09
Emission Rate, grams/second	g/s	1.40E-10	1.26E-10	1.49E-10		1.38E-10

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-1

Congener	Concentration			Emission Rate	
	ug/Nm3	ug@12%	ug@7%	lb/hr	grams/sec
MonoPCBs	1.49E-03	2.08E-03	2.13E-03	2.56E-07	3.23E-08
DiPCBs	1.83E-03	2.55E-03	2.62E-03	3.14E-07	3.96E-08
TriPCBs	5.56E-03	7.76E-03	7.97E-03	9.56E-07	1.20E-07
TetraPCBs	7.72E-03	1.08E-02	1.11E-02	1.33E-06	1.67E-07
PentaPCBs	1.03E-03	1.44E-03	1.48E-03	1.77E-07	2.23E-08
HexaPCBs	3.74E-04	5.23E-04	5.37E-04	6.44E-08	8.11E-09
HeptaPCBs	3.80E-04	5.30E-04	5.45E-04	6.54E-08	8.24E-09
OctaPCBs	1.81E-04	2.52E-04	2.59E-04	3.11E-08	3.91E-09
NonaPCBs	7.77E-06	1.08E-05	1.11E-05	1.34E-09	1.68E-10
DecaPCBs	6.47E-06	9.03E-06	9.27E-06	1.11E-09	1.40E-10
TOTAL PCBs	1.86E-02	2.59E-02	2.66E-02	3.19E-06	4.02E-07

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-2

Congener	Concentration			Emission Rate	
	ug/Nm3	ug@12%	ug@7%	lb/hr	grams/sec
MonoPCBs	2.38E-03	3.33E-03	3.42E-03	4.05E-07	5.10E-08
DiPCBs	1.92E-03	2.68E-03	2.75E-03	3.26E-07	4.11E-08
TriPCBs	2.04E-03	2.84E-03	2.92E-03	3.46E-07	4.36E-08
TetraPCBs	1.74E-03	2.42E-03	2.49E-03	2.95E-07	3.72E-08
PentaPCBs	5.02E-04	7.01E-04	7.20E-04	8.54E-08	1.08E-08
HexaPCBs	3.10E-04	4.33E-04	4.44E-04	5.27E-08	6.64E-09
HeptaPCBs	3.65E-04	5.09E-04	5.23E-04	6.20E-08	7.81E-09
OctaPCBs	1.97E-04	2.74E-04	2.82E-04	3.34E-08	4.21E-09
NonaPCBs	2.13E-05	2.97E-05	3.05E-05	3.62E-09	4.56E-10
DecaPCBs	5.89E-06	8.21E-06	8.43E-06	1.00E-09	1.26E-10
 TOTAL PCBs	 9.48E-03	 1.32E-02	 1.36E-02	 1.61E-06	 2.03E-07

Unit 3 FF Outlet
Concentration and Emission Rate Summary
Run Number: 3-O-M23-3

Congener	Concentration			Emission Rate	
	ug/Nm3	ug@12%	ug@7%	lb/hr	grams/sec
MonoPCBs	1.04E-03	1.50E-03	1.50E-03	1.86E-07	2.35E-08
DiPCBs	2.84E-03	4.11E-03	4.12E-03	5.11E-07	6.44E-08
TriPCBs	6.76E-03	9.77E-03	9.78E-03	1.21E-06	1.53E-07
TetraPCBs	8.45E-03	1.22E-02	1.22E-02	1.52E-06	1.91E-07
PentaPCBs	1.15E-03	1.66E-03	1.66E-03	2.06E-07	2.60E-08
HexaPCBs	3.89E-04	5.62E-04	5.63E-04	6.98E-08	8.80E-09
HeptaPCBs	3.58E-04	5.17E-04	5.18E-04	6.43E-08	8.10E-09
OctaPCBs	1.68E-04	2.42E-04	2.43E-04	3.01E-08	3.79E-09
NonaPCBs	2.07E-05	2.99E-05	2.99E-05	3.71E-09	4.68E-10
DecaPCBs	6.59E-06	9.52E-06	9.54E-06	1.18E-09	1.49E-10
TOTAL PCBs	2.12E-02	3.06E-02	3.07E-02	3.81E-06	4.79E-07

Unit 3 FF Outlet
Average Concentration and Emission Rate Summary

<u>Congener</u>	<u>Concentration</u>			<u>Emission Rate</u>	
	<u>ug/Nm3</u>	<u>ug@12%</u>	<u>ug@7%</u>	<u>lb/hr</u>	<u>grams/sec</u>
MonoPCBs	1.64E-03	2.30E-03	2.35E-03	2.82E-07	3.56E-08
DiPCBs	2.20E-03	3.11E-03	3.16E-03	3.84E-07	4.84E-08
TriPCBs	4.78E-03	6.79E-03	6.89E-03	8.39E-07	1.06E-07
TetraPCBs	5.97E-03	8.47E-03	8.59E-03	1.05E-06	1.32E-07
PentaPCBs	8.94E-04	1.27E-03	1.29E-03	1.56E-07	1.97E-08
HexaPCBs	3.58E-04	5.06E-04	5.15E-04	6.23E-08	7.85E-09
HeptaPCBs	3.67E-04	5.19E-04	5.28E-04	6.39E-08	8.05E-09
OctaPCBs	1.82E-04	2.56E-04	2.61E-04	3.15E-08	3.97E-09
NonaPCBs	1.66E-05	2.35E-05	2.38E-05	2.89E-09	3.64E-10
DecaPCBs	6.31E-06	8.92E-06	9.08E-06	1.10E-09	1.38E-10
TOTAL PCBs	1.64E-02	2.32E-02	2.36E-02	2.87E-06	3.62E-07

APPENDIX A.21
Test Results

Unit 3 FF Outlet
Formaldehyde

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M316

Client Name	Covanta Energy Group, Inc.	Operator	EMK
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 3 FF Outlet	Standard Temperature, °F	68
USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1
Run Number	3-O-M316-1	3-O-M316-2	3-O-M316-3
Run Date	08/29/13	08/29/13	08/29/13
Run Start Time	hh:mm	928	1154
Run Stop Time	hh:mm	1032	1258

Sampling Parameters

Meter Calibration Factor	Y	1.0150	1.0150	1.0150	
Y _{OA} Calculated by Test Run	Y _{OA}	1.0055	1.0104	1.0009	
Y _{OA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-16.00	-16.00	-16.00	-16.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.9	29.9	29.9	29.9
Actual Nozzle Diameter	in	0.211	0.211	0.211	
Carbon Dioxide Percentage	% CO ₂	8.7	8.8	8.7	8.7
Oxygen Percentage	% O ₂	11.0	10.9	11.1	11.0
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.3	80.3	80.2	80.3
Total Water Volume Collected	mL	150.7	166.7	157.3	158.2
Sample Volume	ft ³	33.300	33.780	33.175	33.418
Average Meter Temperature	°F	74	77	79	77
Average Stack Temperature	°F	294	294	294	294
Average Delta H	in H ₂ O	1.03	1.06	1.00	1.03
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	7.093	7.847	7.404	7.448
Volume Metered @ STP	DSCF	33.478	33.773	33.021	33.424
Absolute Stack/Duct Pressure	in Hg	28.7	28.7	28.7	28.7
Absolute Meter Pressure	in Hg	30.0	30.0	30.0	30.0
Calculated Stack Moisture	% H ₂ O	17.5	18.9	18.3	18.2
Dry Mole Fraction	decimal	0.825	0.811	0.817	0.818
Avg Square of Differential Pressure	in H ₂ O	0.986	1.003	0.973	0.987
Avg Square of Diff. Pres., Squared	in H ₂ O	0.973	1.005	0.947	0.975
Dry Gas Molecular Weight	lb/lb-mole	29.83	29.84	29.84	29.84
Wet Stack Gas Molecular Weight	lb/lb-mole	27.76	27.61	27.67	27.68
Average Stack Gas Velocity	ft/sec	68.88	70.23	68.06	69.06
Percent of Isokinetic Rate	% ISO	100.3	100.9	101.1	100.8

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	89,465	91,217	88,401	89,695
Dry Standard Stack Flow/Minute	DSCFM	49,626	49,736	48,555	49,306
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	35,345	35,781	34,233	35,120

Concentration and Emission Rate Data Summary

Formaldehyde	ug	< 9.87	< 9.77	< 9.82	
Molecular Weight	MW	30.03	30.03	30.03	30.03
Concentration, ug/DSCM	ug/DSCM	< 10.4	< 10.2	< 10.5	< 10.4
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 14.4	< 13.9	< 14.5	< 14.3
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 14.6	< 14.2	< 14.9	< 14.6
Emission Rate, lb/hr	lb/hr	< 0.00194	< 0.00190	< 0.00191	< 0.00192

APPENDIX A.22
Test Results

Unit 3 FF Outlet
Particulate and Metals

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M29

Client Name	Covanta Energy Group, Inc.	Operator	EMK
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 3 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number	3-O-M29-1	3-O-M29-2	3-O-M29-3	
Run Date	09/05/13	09/05/13	09/05/13	
Run Start Time	hh:mm	810	1047	
Run Stop Time	hh:mm	1026	1301	

Sampling Parameters

Meter Calibration Factor	Y	1.0150	1.0150	1.0150	
Y _{QA} Calculated by Test Run	Y _{QA}	1.0159	1.0153	1.0102	
Y _{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-14.70	-14.70	-15.70	-15.03
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.8	29.8	29.8	29.8
Actual Nozzle Diameter	in	0.211	0.212	0.211	
Carbon Dioxide Percentage	% CO ₂	8.8	7.9	8.0	8.2
Oxygen Percentage	% O ₂	11.0	11.9	11.8	11.6
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.2	80.2	80.2
Total Water Volume Collected	mL	334.8	307.3	319.0	320.4
Sample Volume	ft ³	69.285	68.315	68.120	68.573
Average Meter Temperature	°F	76	78	80	78
Average Stack Temperature	°F	293	293	293	293
Average Delta H	in H ₂ O	1.13	1.08	1.07	1.09
Total Sampling Time	min	120	120	120	120

Air Flow Parameters

Volume of Water vapor @ STP	SCF	15.759	14.465	15.015	15.080
Volume Metered @ STP	DSCF	69.180	67.879	67.482	68.180
Absolute Stack/Duct Pressure	in Hg	28.7	28.7	28.6	28.7
Absolute Meter Pressure	in Hg	29.9	29.9	29.9	29.9
Calculated Stack Moisture	% H ₂ O	18.6	17.6	18.2	18.1
Dry Mole Fraction	decimal	0.814	0.824	0.818	0.819
Avg Square of Differential Pressure	in H ₂ O	1.013	0.973	0.975	0.987
Avg Square of Diff. Pres., Squared	in H ₂ O	1.026	0.948	0.950	0.975
Dry Gas Molecular Weight	lb/lb-mole	29.85	29.74	29.75	29.78
Wet Stack Gas Molecular Weight	lb/lb-mole	27.65	27.68	27.61	27.65
Average Stack Gas Velocity	ft/sec	70.86	68.03	68.29	69.06
Percent of Isokinetic Rate	% ISO	102.0	101.9	102.9	102.3

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	92,045	88,365	88,698	89,703
Dry Standard Stack Flow/Minute	DSCFM	50,432	49,041	48,729	49,401
Dry Standard Flow/Minute @ 7% O ₂	DSCFM7	35,919	31,753	31,902	33,191

Concentration and Emission Rate Data Summary						
Filterable Particulate	mg	1.7	2.1	2.0		1.9
Concentration, gr/DSCF	gr/DSCF	3.79E-04	4.77E-04	4.57E-04		4.38E-04
Concentration, gr/DSCF @ 12% CO ₂	Gr@12%	5.17E-04	7.25E-04	6.86E-04		6.43E-04
Concentration, gr/DSCF @ 7% O ₂	Gr@7%	5.32E-04	7.37E-04	6.99E-04		6.56E-04
Concentration, mg/DSCM	mg/DSCM	0.868	1.09	1.05		1.00
Concentration, mg/DSCM @ 7% O ₂	mg@7%	1.22	1.69	1.60		1.50
Emission Rate, lb/hr	lb/hr	0.164	0.201	0.191		0.185
Arsenic (As)	ug	0.239	0.313	0.230		0.261
Concentration, ug/DSCM	ug/DSCM	0.122	0.163	0.120		0.135
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	0.166	0.247	0.181		0.198
Concentration, ug/DSCM @ 7% O ₂	ug@7%	0.171	0.251	0.184		0.202
Emission Rate, lb/hr	lb/hr	2.30E-05	2.99E-05	2.20E-05		2.50E-05
Beryllium (Be)	ug	< 0.050	< 0.050	< 0.050		< 0.050
Concentration, ug/DSCM	ug/DSCM	< 0.0255	< 0.0260	< 0.0262		< 0.0259
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 0.0348	< 0.0395	< 0.0392		< 0.0379
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 0.0358	< 0.0402	< 0.0400		< 0.0387
Emission Rate, lb/hr	lb/hr	< 4.82E-06	< 4.78E-06	< 4.78E-06		< 4.79E-06
Cadmium (Cd)	ug	0.357	0.447	0.368		0.391
Concentration, ug/DSCM	ug/DSCM	0.182	0.232	0.193		0.202
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	0.248	0.353	0.289		0.297
Concentration, ug/DSCM @ 7% O ₂	ug@7%	0.256	0.359	0.294		0.303
Emission Rate, lb/hr	lb/hr	3.44E-05	4.27E-05	3.52E-05		3.74E-05
Total Chromium (Cr)	ug	3.650	3.525	3.470		3.548
Concentration, ug/DSCM	ug/DSCM	1.86	1.83	1.82		1.84
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	2.54	2.79	2.72		2.68
Concentration, ug/DSCM @ 7% O ₂	ug@7%	2.62	2.83	2.77		2.74
Emission Rate, lb/hr	lb/hr	3.52E-04	3.37E-04	3.31E-04		3.40E-04
Lead (Pb)	ug	5.050	11.050	4.700		6.933
Concentration, ug/DSCM	ug/DSCM	2.58	5.75	2.46		3.60
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	3.51	8.73	3.69		5.31
Concentration, ug/DSCM @ 7% O ₂	ug@7%	3.62	8.88	3.76		5.42
Emission Rate, lb/hr	lb/hr	4.87E-04	1.06E-03	4.49E-04		6.64E-04
Manganese (Mn)	ug	4.670	4.355	4.040		4.355
Concentration, ug/DSCM	ug/DSCM	2.38	2.27	2.11		2.25
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	3.25	3.44	3.17		3.29
Concentration, ug/DSCM @ 7% O ₂	ug@7%	3.35	3.50	3.23		3.36
Emission Rate, lb/hr	lb/hr	4.50E-04	4.16E-04	3.86E-04		4.17E-04
Mercury (Hg)	ug	< 1.800	< 1.800	< 1.800		< 1.800
Concentration, ug/DSCM	ug/DSCM	< 0.92	< 0.94	< 0.94		< 0.93
Concentration, ug/DSCM @ 12% CO ₂	ug@12%	< 1.25	< 1.42	< 1.41		< 1.36
Concentration, ug/DSCM @ 7% O ₂	ug@7%	< 1.29	< 1.45	< 1.44		< 1.39
Emission Rate, lb/hr	lb/hr	< 1.74E-04	< 1.72E-04	< 1.72E-04		< 1.73E-04

Nickel (Ni)	ug	4.590	3.825	4.620		4.345
Concentration, ug/DSCM	ug/DSCM	2.34	1.99	2.42		2.25
Concentration, ug/DSCM @ 12% CO2	ug@12%	3.19	3.02	3.63		3.28
Concentration, ug/DSCM @ 7% O2	ug@7%	3.29	3.07	3.69		3.35
Emission Rate, lb/hr	lb/hr	4.43E-04	3.66E-04	4.41E-04		4.16E-04
Vanadium (V)	ug	< 0.200	< 0.200	< 0.200		< 0.200
Concentration, ug/DSCM	ug/DSCM	< 0.102	< 0.104	< 0.105		< 0.104
Concentration, ug/DSCM @ 12% CO2	ug@12%	< 0.139	< 0.158	< 0.157		< 0.151
Concentration, ug/DSCM @ 7% O2	ug@7%	< 0.143	< 0.161	< 0.160		< 0.155
Emission Rate, lb/hr	lb/hr	< 1.93E-05	< 1.91E-05	< 1.91E-05		< 1.92E-05
Zinc (Zn)	ug	38.900	36.950	37.800		37.883
Concentration, ug/DSCM	ug/DSCM	19.9	19.2	19.8		19.6
Concentration, ug/DSCM @ 12% CO2	ug@12%	27.1	29.2	29.7		28.6
Concentration, ug/DSCM @ 7% O2	ug@7%	27.9	29.7	30.2		29.3
Emission Rate, lb/hr	lb/hr	3.75E-03	3.53E-03	3.61E-03		3.63E-03

Removal Efficiency Summary For: Mercury

Unit #	Repetition Number	ug/DSCM @ 7% O2		Removal Efficiency, %
		Inlet Result	Stack Result	
3	1	93.5	1.29	98.6%
	2	27.8	1.45	94.8%
	3	27.1	1.44	94.7%
AVERAGE =>				96.0%

APPENDIX A.23
Test Results

Unit 3 FF Outlet
PM10

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD:

M201A

Client Name	Covanta Energy Group, Inc.			Operator	WES
Plant Name	Huntington Resource Recovery Facility			Project #	13022
Sampling Location	Unit 3 FF Outlet			Standard Temperature, °F	68
USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE	
Run Number		3-O-M201A-1	3-O-M201A-2		3-O-M201A-3
Run Date		08/28/13	08/28/13		08/28/13
Run Start Time	hh:mm	831	1144		1352
Run Stop Time	hh:mm	1036	1348		1559
Sampling Parameters					
Meter Calibration Factor	Y	1.0150	1.0150	1.0077	
Y_{QA} Calculated by Test Run	Y _{QA}	0.9948	0.9890	1.0065	
Y_{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.7617	0.7382	0.7617	
Stack/Duct Static Pressure	in H ₂ O	-15.00	-16.00	-16.00	-15.67
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.7	29.7	29.7	29.7
Actual Nozzle Diameter	in	0.164	0.164	0.164	
Carbon Dioxide Percentage	% CO ₂	8.3	8.9	9.0	8.7
Oxygen Percentage	% O ₂	11.5	10.7	10.6	10.9
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.2	80.4	80.4	80.3
Total Water Volume Collected	mL	180.3	182.5	183.3	182.0
Sample Volume	ft ³	40.920	43.094	41.937	41.984
Average Meter Temperature	°F	85	90	87	87
Average Stack Temperature	°F	294	294	293	294
Average Delta H	in H ₂ O	0.38	0.39	0.35	0.37
Total Sampling Time	min	117.75	121.25	120.50	119.83
Air Flow Parameters					
Volume of Water vapor @ STP	SCF	8.487	8.590	8.628	8.568
Volume Metered @ STP	DSCF	39.946	41.744	40.512	40.734
Absolute Stack/Duct Pressure	in Hg	28.6	28.5	28.5	28.5
Absolute Meter Pressure	in Hg	29.7	29.7	29.7	29.7
Calculated Stack Moisture	% H ₂ O	17.5	17.1	17.6	17.4
Reported Stack Moisture Content	% H ₂ O	17.5	17.1	17.6	17.4
Dry Mole Fraction	decimal	0.825	0.829	0.824	0.826
Avg Square of Differential Pressure	in H ₂ O	1.034	1.079	1.052	1.055
Avg Square of Diff. Pres., Squared	in H ₂ O	1.069	1.165	1.106	1.113
Dry Gas Molecular Weight	lb/lb-mole	29.79	29.85	29.86	29.83
Wet Stack Gas Molecular Weight	lb/lb-mole	27.72	27.83	27.78	27.78
Average Stack Gas Velocity	ft/sec	65.66	66.39	66.77	66.27
Percent of Isokinetic Rate	% ISO	106.4	106.5	103.9	105.6
Air Flow Rate Results					
Actual Stack Flow/Minute	ACFM	85,287	86,234	86,723	86,081
Dry Standard Stack Flow/Minute	DSCFM	47,070	47,728	47,767	47,521
Dry Standard Flow/Minute @ 7% O₂	DSCFM7	31,831	35,023	35,395	34,083
Cyclone Calculations					
Sample Flow Rate at Standard Conds.	Q _{sST}	0.339	0.344	0.336	0.340
Cyclone Flow at Actual Conditons	Q _s	0.615	0.622	0.610	0.616
Flue Gas Viscosity, micropoise	μ	217.2	217.2	216.5	217.0
Reynolds Number	Nre	2571	2604	2562	2579
PM 10 Particle Cut Size	D ₅₀	9.91	9.83	9.94	9.89
Cunningham Correction Factor	C	1.091	1.091	1.090	1.091
QA/QC Calculations					
%ISO Results, 80% < I < 120%	ISO %	YES	YES	YES	YES
PM10 Cut Size, 9um < D₅₀ < 11um	PM10	YES	YES	YES	YES
% of Catch <10um	%	45.8	28.6	40.7	38.4

Concentration and Emission Rate Data Summary						
Particulate Fraction <10 microns	mg	1.1	0.8	1.1		1.0
Concentration, Gr/DSCF	gr/DSCF	4.25E-04	2.96E-04	4.19E-04		3.80E-04
Concentration, Gr/DSCF @ 12% CO ₂	Gr@12%	6.14E-04	3.99E-04	5.59E-04		5.24E-04
Concentration, Gr/DSCF @ 7% O ₂	Gr@7%	6.28E-04	4.03E-04	5.65E-04		5.32E-04
Concentration, mg/DSCM	mg/DSCM	0.972	0.677	0.959		0.869
Concentration, mg/DSCM @ 7% O ₂	mg@7%	1.44	0.922	1.29		1.22
Emission Rate, lb/hr	lb/hr	0.171	0.121	0.172		0.155

APPENDIX A.24
Test Results

Unit 3 FF Outlet
Sulfuric Acid Mist

ISOKINETIC SAMPLING TRAIN RESULTS - METHOD

M8

Client Name	Covanta Energy Group, Inc.	Operator	EMK
Plant Name	Huntington Resource Recovery Facility	Project #	13022
Sampling Location	Unit 3 FF Outlet	Standard Temperature, °F	68

USE IN AVERAGE OF RUN SET? 1 or 0 =>	1	1	1	SET AVERAGE
Run Number	3-O-M8-1	3-O-M8-2	3-O-M8-3	
Run Date	08/29/13	08/29/13	08/29/13	
Run Start Time	hh:mm	815	1042	
Run Stop Time	hh:mm	922	1147	

Sampling Parameters

Meter Calibration Factor	Y	1.0077	1.0077	1.0077	
Y_{QA} Calculated by Test Run	Y _{QA}	0.9874	0.9935	0.9879	
Y_{QA} PASS/FAIL by Test Run	Check	PASS	PASS	PASS	PASS
Pitot Tube Coefficient	C _p	0.84	0.84	0.84	
Stack/Duct Static Pressure	in H ₂ O	-16.00	-16.00	-16.00	-16.00
Stack Cross-Sectional Area	ft ²	21.648	21.648	21.648	21.648
Barometric Pressure	in Hg	29.9	29.9	29.9	29.9
Actual Nozzle Diameter	in	0.214	0.210	0.210	
Carbon Dioxide Percentage	% CO ₂	8.6	8.7	8.9	8.7
Oxygen Percentage	% O ₂	11.1	11.1	10.9	11.0
Carbon Monoxide Percentage	% CO	0.0	0.0	0.0	0.0
Nitrogen Percentage	% N ₂	80.3	80.2	80.2	80.2
Total Water Volume Collected	mL	200.7	142.8	173.2	172.2
Sample Volume	ft ³	34.840	33.660	33.710	34.070
Average Meter Temperature	°F	73	77	79	76
Average Stack Temperature	°F	293	293	293	293
Average Delta H	in H ₂ O	0.98	0.92	0.91	0.93
Total Sampling Time	min	60	60	60	60

Air Flow Parameters

Volume of Water vapor @ STP	SCF	9.447	6.722	8.153	
Volume Metered @ STP	DSCF	34.854	33.386	33.307	33.849
Absolute Stack/Duct Pressure	in Hg	28.7	28.7	28.7	28.7
Absolute Meter Pressure	in Hg	30.0	30.0	30.0	30.0
Calculated Stack Moisture	% H ₂ O	21.3	16.8	19.7	19.2
Dry Mole Fraction	decimal	0.787	0.832	0.803	0.808
Avg Square of Differential Pressure	in H ₂ O	0.986	0.991	0.986	0.988
Avg Square of Diff. Pres., Squared	in H ₂ O	0.972	0.983	0.971	0.975
Dry Gas Molecular Weight	lb/lb-mole	29.82	29.84	29.86	29.84
Wet Stack Gas Molecular Weight	lb/lb-mole	27.30	27.85	27.53	27.56
Average Stack Gas Velocity	ft/sec	69.38	69.06	69.08	69.17
Percent of Isokinetic Rate	% ISO	105.5	99.7	103.1	102.8

Air Flow Rate Results

Actual Stack Flow/Minute	ACFM	90,118	89,694	89,724	
Dry Standard Stack Flow/Minute	DSCFM	47,727	50,271	48,503	48,834
Dry Standard Flow/Minute @ 7% O₂	DSCFM7	33,649	35,443	34,894	34,662

Concentration and Emission Rate Data Summary						
Sulfuric Acid Mist (Ion Chromatography)	mg	< 0.048	< 0.033	< 0.038		
Molecular Weight	MW	98.08	98.08	98.08	98.08	
Concentration, ppm	ppm	< 0.0119	< 0.0086	< 0.0099		< 0.0101
Concentration, ppm @ 12% CO ₂	ppm@12%	< 0.0166	< 0.0118	< 0.0133		< 0.0139
Concentration, ppm @ 7% O ₂	ppm@7%	< 0.0169	< 0.0121	< 0.0137		< 0.0143
Emission Rate, lb/hr	lb/hr	< 0.00869	< 0.00657	< 0.00732		< 0.00753

APPENDIX A.25

Test Results

Unit 3 FF Outlet
Total Hydrocarbons as Ethane

CONCENTRATION AND EMISSION RATE DATA SUMMARY

Client Name	Covanta Energy Group, Inc.			
Plant Name	Huntington Resource Recovery Facility			
Sampling Location	Unit 3 FF Outlet			
Operator	13022			
Project #	PJJ			
Repetition Number		1	2	3
Run Date		08/29/13	08/29/13	08/29/13
Run Start Time	hh:mm	803	1007	1205
Run Stop Time	hh:mm	952	1151	1350

Unit 3 FF Outlet					
Moisture Content	% H ₂ O	20.0	17.0	19.2	18.7
Dry Mole Fraction	Mfd	0.800	0.830	0.808	0.813
Oxygen Percentage	% O ₂	11.052	10.471	10.795	10.772
Carbon Dioxide Percentage	% CO ₂	8.781	9.114	8.941	8.946
Dry Standard Stack Flow Rate	DSCFM	48,360	50,056	49,325	49,247

Unit 3 FF Outlet					
Total Hydrocarbons (as Ethane)					
Formula Weight	Fwt	30.06	30.06	30.06	30.06
Concentration, ppm (wet)	ppmvw	0.084	0.097	0.101	0.094
Concentration, ppm (dry)	ppmvd	0.106	0.117	0.125	0.116
Concentration, ppm@7%O₂	ppm@7%O ₂	0.150	0.155	0.171	0.159
Concentration, ppm@12%CO₂	ppm@12%CO ₂	0.145	0.153	0.167	0.155
Emission Rate, lb/hr	lb/hr	0.024	0.028	0.029	0.027

CONCENTRATION AND EMISSION RATE SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery
Sampling Location	Unit 3 FF Outlet
Operator	13022
Project #	PJJ

USE IN AVERAGE OF RUN SET? 1 or 0 =>		1	1	1	
CEM Run Number		1	2	3	
Run Date		08/29/13	08/29/13	08/29/13	
Run Start Time	hh:mm	803	845	928	
Run Stop Time	hh:mm	827	909	952	SET AVERAGE

Unit 3 FF Outlet		% H ₂ O	21.3	21.3	17.5	20.0
Moisture Content	Mfd	0.787	0.787	0.825	0.800	
Dry Mole Fraction	% O ₂	10.998	11.188	10.969	11.052	
Oxygen Percentage	% CO ₂	8.803	8.693	8.848	8.781	
Carbon Dioxide Percentage	DSCFM	47,727	47,727	49,626	48,360	
Air Flow and Moisture Taken From Test Run =>		3-O-M8-1	3-O-M8-1	3-O-M316-1		

Unit 3 FF Outlet		Fwt	30.06	30.06	30.06	
Total Hydrocarbons (as Ethane)	ppmvw	0.099	0.100	0.064	0.084	
Concentration, ppm (wet)	ppmvd	0.126	0.127	0.065	0.106	
Concentration, ppm (dry)	ppm@7%O ₂	0.177	0.182	0.092	0.150	
Concentration, ppm@7%O₂	ppm@12%CO ₂	0.171	0.175	0.089	0.145	
Emission Rate, lb/hr	lb/hr	0.028	0.028	0.015	0.024	

CONCENTRATION AND EMISSION RATE SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery
Sampling Location	Unit 3 FF Outlet
Operator	13022
Project #	PJJ

USE IN AVERAGE OF RUN SET? 1 or 0 =>		1	1	1	
CEM Run Number		4	5	6	
Run Date		08/29/13	08/29/13	08/29/13	
Run Start Time	hh:mm	1007	1048	1127	
Run Stop Time	hh:mm	1031	1112	1151	SET AVERAGE

Unit 3 FF Outlet						
Moisture Content	% H ₂ O	17.5	16.8	16.8	17.0	
Dry Mole Fraction	Mfd	0.825	0.832	0.832	0.830	
Oxygen Percentage	% O ₂	10.633	10.379	10.400	10.471	
Carbon Dioxide Percentage	% CO ₂	9.004	9.141	9.198	9.114	
Dry Standard Stack Flow Rate	DSCFM	49,626	50,271	50,271	50,056	
Air Flow and Moisture Taken From Test Run =>		3-O-M316-1	3-O-M8-2	3-O-M8-2		

Unit 3 FF Outlet					
Total Hydrocarbons (as Ethane)					
Formula Weight of Ethane	Fwt	30.06	30.06	30.06	
Concentration, ppm (wet)	ppmw	0.005	0.094	0.193	0.097
Concentration, ppm (dry)	ppmvd	0.006	0.113	0.232	0.117
Concentration, ppm@7%O₂	ppm@7%O ₂	0.008	0.149	0.307	0.155
Concentration, ppm@12%CO₂	ppm@12%CO ₂	0.008	0.148	0.303	0.153
Emission Rate, lb/hr	lb/hr	0.001	0.027	0.055	0.028

CONCENTRATION AND EMISSION RATE SUMMARY

Client Name	Covanta Energy Group, Inc.
Plant Name	Huntington Resource Recovery
Sampling Location	Unit 3 FF Outlet
Operator	13022
Project #	PJJ

USE IN AVERAGE OF RUN SET? 1 or 0 =>		1	1	1
CEM Run Number		7	8	9
Run Date		08/29/13	08/29/13	08/29/13
Run Start Time	hh:mm	1205	1246	1326
Run Stop Time	hh:mm	1229	1310	1350
				SET AVERAGE

Unit 3 FF Outlet						
Moisture Content	% H ₂ O	18.9	18.9	19.7	19.2	
Dry Mole Fraction	Mfd	0.811	0.811	0.803	0.808	
Oxygen Percentage	% O ₂	10.640	10.965	10.579	10.795	
Carbon Dioxide Percentage	% CO ₂	8.926	8.937	8.961	8.941	
Dry Standard Stack Flow Rate	DSCFM	49,736	49,736	48,503	49,325	
Air Flow and Moisture Taken From Test Run =>		3-O-M316-2	3-O-M316-2	3-O-M8-3		

Unit 3 FF Outlet						
Total Hydrocarbons (as Ethane)						
Formula Weight of Ethane	Fwt	30.06	30.06	30.06	30.06	
Concentration, ppm (wet)	ppmvw	0.090	0.116	0.096	0.101	
Concentration, ppm (dry)	ppmvd	0.111	0.143	0.120	0.125	
Concentration, ppm@7%O₂	ppm@7%O ₂	0.153	0.200	0.161	0.171	
Concentration, ppm@12%CO₂	ppm@12%CO ₂	0.149	0.192	0.160	0.167	
Emission Rate, lb/hr	lb/hr	0.026	0.033	0.027	0.029	

APPENDIX A.26

Example Calculations

CONSTANTS, DEFINITIONS, & NOMENCLATURE

0.04707	Standard cubic feet per gram or milliliter of water @ standard conditions
0.18	Molecular weight of water divided by 100
0.28	Molecular weight of nitrogen divided by 100
0.32	Molecular weight of oxygen divided by 100
0.44	Molecular weight of carbon dioxide divided by 100
0.264	Ratio of O ₂ to N ₂ in air, v/v
0.5	Diatomeric factor
13.6	Specific gravity of mercury
17.64	Conversion factor, standard temperature, standard pressure, (degrees R, inches Hg)
20.9	Percent O ₂ by volume (dry basis) in ambient air
24	Hours per day
24.056	Molar volume liters per mole, STP
85.49	Pitot tube constant, ft./sec.
385.3	Molar volume, ft ³ /mole @ 68 deg. F, 29.92 inches Hg.
60	Minutes per hours, seconds per minute
100	Conversion to percent
460	0 degrees F in degrees R
7,000	Grains per pound
453,592	Milligrams per pound
A	Cross-sectional area of stack, square feet
avg	Average
CTavg	Calibration time, average
%CO ₂	Percent carbon dioxide, volume, dry basis
%CO + N ₂	Percent carbon monoxide and nitrogen, volume, dry basis
Cp	Pitot tube coefficient
Delta H	Average pressure differential of meterbox orifice, inches water
Delta pavg	Average pressure drop
DRE	Destruction and Removal Efficiency
%EA	Percent Excess Air
F	F-factor, dry standard cubic feet per million Btu
Gr/DSCF	Grains per dry standard cubic foot
7% O ₂	Concentration corrected to 7% oxygen
12% CO ₂	Concentration corrected to 12% carbon dioxide
gms/day	Grams per day
%H ₂ O	Percent moisture
Hg	Mercury
%I	Percent isokinetic sampling rate
Lb/hr	Emission rate, pounds per hour
Lb/MMBtu	Emission rate, pounds per million Btu heat input
Mfd	Mole fraction, dry
Md	Molecular weight of flue gas, dry
Ms	Molecular weight of flue gas, wet
mg	Milligrams
mg/DSCM	Milligrams per dry standard cubic meter
Nozzle area	Area of sampling nozzle, square feet
%O ₂	Percent oxygen
Pbar	Barometric pressure, inches Hg
Pg	Flue gas static pressure, inches H ₂ O
ppmd	Concentration, parts per million, dry, volume
Ps	Flue gas absolute pressure, inches Hg
Pstd	Standard absolute pressure at 29.92 inches Hg
Qsd	Volumetric flowrate, dry standard cubic feet per minute
Qaw	Volumetric flowrate, wet actual cubic feet per minute

CONSTANTS, DEFINITIONS, & NOMENCLATURE

(continued)

ta	Ambient temperature
Theta	Run time, minutes
tm	Dry gas meter temperature, degrees F, average of inlet and outlet meter temperatures
ts	Flue gas temperature, degrees F
Tstd	Standard absolute temperature, 528 Rankin
Vlc	Volume of liquid collected, mL
Vm	Volume of metered gas sample, dry, cubic feet
Vm(std)	Volume of metered gas sample, at standard conditions, dry cubic feet
vs	Average flue gas velocity, feet per second
Vsc	Milliliters sampled, dry, STP
Va	Milliliters sampled, actual, dry
Vw(std)	Volume of water vapor, stand cubic feet
Y	Gamma, dry gas meter calibration factor

CALCULATIONS

Volume Metered, Dry, (STP)

$$Vm(\text{std}) = 17.64 * Y * Vm * (P\bar{a}r + \Delta H / 13.6) / (460 + t_m) \text{ ft}^3$$

$$V_{sc} = (17.64 * V_a * P\bar{a}r) / (t_a + 460) \text{ Milliliters}$$

$$V_a = (\Theta * 60 * V_c * Y) / (CT_{avg} * 1000) \text{ Milliliters}$$

Volume of Water Collected, Dry Standard Cubic Feet (STP)

$$V_w(\text{std}) = 0.04707 * V_{lc}$$

Percent Moisture Content

$$\%H_2O = 100 * V_w(\text{std}) / (V_w(\text{std}) + V_m(\text{std}))$$

Mole Fraction of Flue Gas (Dry)

$$M_{fd} = 1 - (\%H_2O / 100)$$

Molecular Weight of Flue Gas (Dry)

$$M_d = (%CO_2 * 0.44) + (%O_2 * 0.32) + ((%CO + %N_2) * 0.28)$$

Molecular Weight of Flue Gas (Wet)

$$M_s = (M_d * M_{fd}) + (0.18 * \%H_2O)$$

Flue Gas Absolute Pressure (" Hg)

$$P_s = P\bar{a}r + (P_g / 13.6)$$

Flue Gas Velocity, Feet per Second, (Delta p avg is square of average square root)

$$v_s = 85.49 * C_p * \text{SQRT}((\Delta p_{avg} * (460 + t_s)) / (P_s * M_s))$$

Volumetric Flowrate, Cubic Feet per Minute (STP), DSCFM

$$Q_{sd} = 60 * M_{fd} * v_s * A * (T_{std} / (t_s + 460)) * (P_s / P_{std})$$

Volumetric Flowrate, Cubic Feet per Minute, (Actual), ACFM

$$Q_{aw} = 60 * vs * A$$

Percent Isokinetic

$$\%I = (P_{std} / T_{std}) * (100 / 60) * ((ts + 460) * v_{m(std)}) / (P_s * v_s * M_{fd} * \Theta * \text{Nozzle area})$$

Heat Input Rate, Million BTU per Hour

$$\text{MMBtu / hr} = 60 * (Q_{sd} / F) * ((20.9 - \%O_2) / 20.9)$$

Percent Excess Air

$$\%EA = 100 * (\%O_2 - (0.5 * \%CO)) / ((0.264 - \%N_2) - (\%O_2 - (0.5 * \%CO)))$$

Grains per Cubic Foot, Dry Standard

$$Gr / DSCF = (7,000 / 453,592) * (mg / V_{m(std)})$$

$$Gr/DSCF = (7,000 * ppmd * \text{Mol. wt.}) / (385.3 E+06)$$

Pounds per Hour

$$Lb/hr = 60 * (mg / 453,592) * (Q_{sd} / V_{m(std)})$$

$$Lb/hr = (60 * ppmd * \text{Mol. wt.} * Q_{sd}) / (385.3 E+06)$$

Pounds per Million BTU

$$Lb/MMBtu = (mg / 453,592) * (F / V_{m(std)}) * (20.9 / (20.9 - \%O_2))$$

$$Lb/MMBtu = ((ppmd * \text{Mol. wt.}) / (385.3 E+06)) * F * (20.9 / (20.9 - \%O_2))$$

Parts per Million, Dry Volume

$$ppmd = (385.3 E+06 * mg) / (453,592 * \text{Mol. wt.} * V_{m(std)}) \text{ ft}^3$$

$$ppmd = 1,000,000 * (24.056 * mg/1000) / (V_{sc} * \text{Mol. Wt.}) \text{ milliliters}$$

$$ppmd = 1,000,000 * (24.056 * ug/1,000,000) / (V_{sc} * \text{Mol. Wt.}) \text{ milliliters}$$

Milligrams per Cubic Meter, Dry Standard

$$\text{mg/DSCM} = \text{ppmd} * (\text{Mol. wt.} / 24.056)$$

Grams per Day

$$\text{gms/day} = 24 * 60 * (\text{ug}/10E+06) * \text{Qsd} / \text{Vm(std)}$$

Corrections

7% O₂ multiply by (20.9-7) / (20.9 - O₂)
12% CO₂ multiply by (12 / %CO₂)